VOLUME 16/NUMBER 20
OCTOBER 23, 1978
ACC. NOS. N78-29044 TO N78-30037

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 16, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.

US ISSN 0036-8741

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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VOLUME 16 NUMBER 20 / OCTOBER 23, 1978

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 2617

02 AERODYNAMICS 2619

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 2621

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 2622

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2622

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2625

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2625

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For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 2627

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 2627

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

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For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 2628

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 2629

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 2630

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 2630

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 2631

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2632

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION **N.A.**
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER **2632**
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
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23 CHEMISTRY AND MATERIALS (GENERAL) **2632**
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **2633**
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **2634**
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **2639**
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **2644**
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **2648**
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

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For related information see also *Physics*.

31 ENGINEERING (GENERAL) **2650**
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **2652**
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING **2658**
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER **2665**
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY **2669**
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS **2670**
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **2672**
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **2675**
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **2677**
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

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Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES 2682
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 2687
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 2694
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2699
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 2704
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48 OCEANOGRAPHY 2706
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51 LIFE SCIENCES (GENERAL) 2707
Includes genetics.

52 AEROSPACE MEDICINE 2708
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2710
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2711
Includes human engineering; biotechnology; and space suits and protective clothing.

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Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

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59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2712
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 2715
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2717
Includes computer networks.

63 CYBERNETICS 2717
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 2718
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2721
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2723
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 2723
Includes topology and number theory.

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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 2724
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 2724
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 2726
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2728
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 2729
Includes light phenomena.

75 PLASMA PHYSICS 2730
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 2733
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2737
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2738
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83 ECONOMICS AND COST ANALYSIS 2740
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2741
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2744
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2745
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2745
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2746
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2747
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

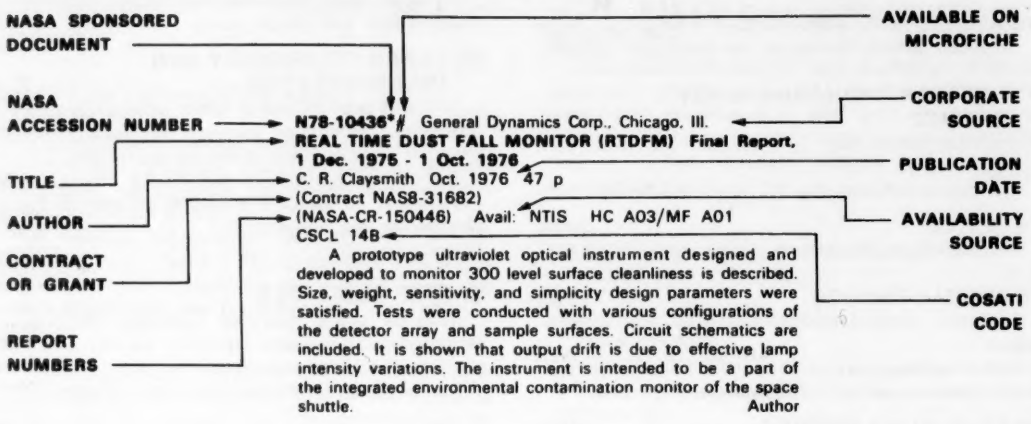
GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-47
CORPORATE SOURCE INDEX I-53
CONTRACT NUMBER INDEX I-67
REPORT/ACCESSION NUMBER INDEX I-71

TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
PUBLICATION DATE
C. R. Claysmith Oct. 1976 47 p
AUTHOR
(Contract NAS8-31682)
AVAILABILITY SOURCE
CONTRACT OR GRANT
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
CSCL 14B
COSATI CODE
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author
REPORT NUMBERS

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, INVESTIGATION OF ADVANCED PROGNOSTIC ANALYSIS TECHNIQUES
J.J. REIS, Northrop Corporation, *Hawthorne, California* 90250 (DA0E3782; DAAJ02-77-C-0054)

To analyze data acquired under a previous Northrop contract, DAAJ02-75-c-0019, where vibration data was acquired from UH-1 helicopter gearboxes which were run in a test cell at the contractor's facility to failure. The purpose of the analysis effort will be one of evaluating signal processing techniques for their ability to prognosticate gearbox failures.

The contract will perform a theoretical investigation and data analysis to develop and optimize trend detection and prediction algorithms for application to the test cell data previously collected. The mathematical concepts to be investigated shall emphasize: (1) the reverse arrangement trend detection; (2) cepstrum; and (3) matched filter techniques. Comprehensive data processing shall be conducted to determine the quantitative performance on the test cell data of the various algorithms developed. A parametric study shall be performed comparing the onset of trend detection with each enhancement technique versus observation time and trend prediction accuracy.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0002, ACTIVE FLUTTER SUPPRESSION ON AEROELASTICALLY TAILORED HIMAT VEHICLE
J.H. WYKES, Rockwell International Corp., *Los Angeles, California* 90009 (DF141060; F33615-78-C-3200)

The HIMAT vehicle has aeroelastically tailored wings for improved maneuverability. The aeroelastic twist control design approach resulted in low flutter speeds and rather than revise the structural design, mass balance weights were added to the wings and canards. The objective of this effort is to define the feasibility and potential benefits of an active flutter suppression system on aeroelastically tailored composite wings. An active flutter suppression system may provide a more efficient, weight-saving approach.

Using the available HIMAT data, an analytical model will be developed and an active flutter suppression system will be synthesized. Trade-off studies will include system gain and compensation, sensor locations, size of control surfaces, maximum deflection and rate, and gust level to evaluate feasiblity of the active flutter suppression system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, UNSTEADY FLOW OF AN OSCILLATING AIRFOIL IN TRANSLATIONAL MOTION 14741-E
C.M. HO, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DA0F9137; DAAG29-78-G-0023)

To investigate the unsteady velocity and pressure fields about an oscillating airfoil in translational motion normal to the free stream, in order to study the unsteady leading edge separation and the unsteady kutta condition. Relevance - the description of the unsteady flow environment of a plunging airfoil is of direct relevance to understanding and predicting helicopter retreating blade stall and stall flutter, the delimiters of helicopter performance in forward motion.

The velocity and pressure fields of a heaving airfoil using novel measuring (hot-wire anemometry) and data processing techniques (mini-computer) will be determined for a range of Reynolds numbers and reduced frequency of oscillation. Details of leading edge vortex bursting, subsequent viscous-inviscid flow interaction and unsteady flow about the sharp trailing edge will be quantitatively determined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0004, FABRICATION OF BORON/ALUMINUM SUBCOMPONENT SKINS FOR RPV WINGS
R. TAYLOR, Amercom Incorporated, *Northridge, California* (DN881352; N62269-77-C-0288)

To fabricate two boron/aluminum skins for a test subcomponent representing the critical area of a high-temperature wing design. This contract supports work unit GC328, 'Advanced Composite High-Temperature Structure', Agency Accession No. DN481024.

Skins will be fabricated by diffusion bonding and nondestructively inspected. Holes will be formed using EDM drilling.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0005, APPLICABILITY OF ELASTIC LAYER VERSUS WESTERGAARD ANALYSIS FOR AIRFIELD PAVEMENT
J.E. CRAWFORD, U.S. Navy, Civil Engineering Lab., *Port Hueneme, California* 93042 (DN887004)

To establish guidance as to which technique, Westergaard or elastic layer, provides the analysis most appropriate to Navy-type airfield pavements.

Using data derived from rigid pavement sections tested at CEL during the last three years, the effectiveness of the Westergaard and elastic layer analyses for naval air stations will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Civil Engineering Lab.

1.0006, ALTERNATE AIRCRAFT TAKEOFF SYSTEM FOR AIRCRAFT LAUNCH FROM BOMB-DAMAGED AIRFIELDS - CONCEPT DEVELOPMENT EFFORT 1
T.D. EARL, Vehicle Systems Develop. Corp., *Upland, California* 91786 (DF140300; F33615-77-C-2052)

This effort is in support of research and development goals aimed at improving the readiness of Air Force aircraft to rapidly accomplish assigned missions. It is part of a program to develop an alternate aircraft takeoff system (AATS) for aircraft launch from bomb-damaged airfields. Presently, enemy-inflicted damage to paved runways can prohibit the rapid launch of aircraft to ac-

complish critical wartime missions. Thereby, an enemy can significantly increase its ability to successfully wage war. The objective of this effort is to develop and evaluate AATS concepts. Based on the results of this effort, the promising AATS concepts will be selected for further development.

This work unit is for one of two separate concurrent contract efforts aimed at the initial development and evaluation of alternate aircraft takeoff system (AATS) concepts. Under each of these contracts, AATS subsystems will be defined, evaluated, and used to synthesize AATS concepts. Then, feasible concepts will be improved upon, evaluated and the most promising AATS concepts selected. Finally, the three most promising AATS concepts will be further developed, and a trade study performed to provide a sound basis for the selection of primary and alternate AATS concepts that will be further developed under follow-on in-house and contract work units.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, JET-DIFFUSER AUGMENTOR DEVELOPMENT
M. ALPERIN, Flight Dynamics Research Corp., *Van Nuys, California* 91406 (DN881149; N6226.-77-C-0232)

To develop an end-wall design procedure for minimizing end-wall losses and demonstrate performance improvement of the jet diffuser augmenter. This contract supports work unit ZA601, 'Aircraft Technology,' Agency Accession Number DN681080.

An internal aerodynamic analysis will be conducted to determine candidate optimum end-wall shapes. One (or more) new end-wall configuration will be incorporated into an existing jet diffuser augmenter laboratory model and tested for correlation with predicted results.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0008, REGRESSION SIMULATION TURBINE PERFORMANCE (P AND W)
J. ALCOCK, United Technologies Corp., *West Palm Beach, Florida* 33402 (DF462360; F33615-77-C-2109)

The objective of this program is reduce the cost of using the procedures developed under the TEVCS/ARES programs (Contracts F33615-73-C-2070 and F33615-73-C-2084, respectively) while maintaining or improving the accuracy levels necessary for a meaningful propulsion concept evaluation and/or cycle selection.

Based on the above objective, four major tasks have been identified for investigation and evaluation. Task I deals directly with reducing propulsion data generation costs by reducing parametric deck size and by improving computer execution time per data point. Task II reduces the amount of propulsion data required to assess a given engine design. Task III provides the data base necessary to permit the propulsion manufacturer to establish in-house the important preliminary propulsion characteristics based on a realistic airframe data base. This should allow the propulsion manufacturer to tailor general propulsion concepts to a specific application and to identify meaningful propulsion variables which are well-suited for use in the TEVCS/ARES methodologies. Task IV is concerned with improving the accuracy of the present TEVCS/ARES regression procedures to improve concept evaluation and cycle selection capability and to accommodate possible inaccuracies due to the propulsion data cost reductions developed in Task I.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0009, DESIGN, TESTING, AND ANALYSIS OF PITCH-FREE WING AIRCRAFT TREND FLUTTER MODELS - A NEW CONCEPT
H.T. YANG, Purdue University, School of Aero. Astr. Eng. Sci, *Lafayette, Indiana* 47907 (PRF 8700)

OBJECTIVE: The pitch-free wing aircraft has many advantages as compared with the conventional aircraft with fixed-root wings. Among these are better ride quality, gust alleviation, freedom in locating the main landing gear, and better combat maneuverability. This research is to investigate the flutter characteristics of such aircraft based on several simple models and compare such characteristics with the conventional fixed-root aircraft.

APPROACH: The natural frequencies and modes are analyzed by the finite-element method. The aerodynamic pressures are computed by the doublet-lattice method. The flutter speed is computed by the V-g method. A wind-tunnel test is also proposed.

PROGRESS: Several models have been designed and structural dynamic behaviors have been analyzed.

SUPPORTED BY Purdue Research Foundation

1.0010, INVESTIGATION OF ADVANCED R AND M ANALYTICAL TECHNIQUES
J. FLORENCE, Rail Company, *Baltimore, Maryland* 21220 (DA0E3796; DAAJ02-77-C-0080)

To perform experimental developmental or research work to support modeling and analysis in conducting DOD analyses of Army Aircraft such as the CH-47D, UTTAS, AAH, and AH-IS and other systems such as SOTAS, XM-1, etc.

The contractor will provide engineering and programming support for maintaining and updating the arms models as required.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0011, ANALYZE AND EVALUATE ELEMENTS OF ADVANCED SYSTEMS REQUIREMENTS
C. KING, Booz Allen & Hamilton Inc., *Bethesda, Maryland* 20014 (DN890043; N00019-78-C-0087)

To have limited analysis and evaluation of advanced system requirements that are critical to future aircraft weapon systems development programs.

Contractor to analyze and evaluate government information on advanced systems requirements and research and exploratory developments that are critical to future aircraft weapon systems development programs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0012, AIRBORNE FERROGRAPH DEVELOPMENT
E.R. BOWEN, Foxboro Transsonics Inc., *Burlington, Massachusetts* 01803 (DN796802; N00140-76-C-0713)

The principal objective is to develop and fabricate for evaluation engine-mounted sensors to detect impending oil-wetted parts failures in gas turbine engines. This contract will determine the best method of measuring the wear debris deposited by the magnetic precipitation technique. The candidate approaches are: resistive, inductive, capacitive and optical. The goal is to detect 95% of bearing or gear failures in sufficient time to avoid catastrophic failure or secondary damage. The technical effort is based on previous development contract numbers N00140-72-C-6082 and N00140-73-C-1065.

The initial twelve months of this effort consists of final system design, with particular consideration given to reducing weight and size, and prototype fabrication and delivery. This prototype unit will be evaluated at NAPTC to verify operating characteristics on a gas turbine engine. Upon successful completion of the evaluation, go-ahead for fabrication of five additional units will be issued. If the evaluation reveals a need for re-design, a three-month re-design, re-evaluation period is provided before go-ahead for additional units.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0013, EFFECT OF SERVICE ENVIRONMENT ON F-15 BORON EPOXY STABILATOR
T.V. HINKLE, McDonnell Douglas Astro. Co., *St. Louis, Missouri* 63166 (DF140780; F33615-77-C-3124)

There is laboratory evidence that the mechanical properties of epoxy matrix composite materials are degraded by moisture absorption. Available data on the effects of moisture pick-up during in-service operation on aircraft components is limited. There is a need for additional information to establish a technology base from which structural life predictions can be made for composite materials. The program objective is to accomplish this by evaluating the moisture levels and strength of the horizontal stabilators on the F-15 aircraft after extended periods of service.

Two F-15 in-service stabilators that have a well-documented high-humidity environmental history will be used as test specimens for this program. The first specimen will be used to establish a base line by conducting a moisture content analysis of the stabilator in the as-received condition and compare the results with analytical methods. A series of tests will then be performed on humid-aged coupons cut from the stabilator to determine structural degradation at various moisture levels. The second F-15 stabilator will be installed on another aircraft for additional service environmental exposure and then evaluated as a part of a future program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, ADVANCED AVIATION ENGINEERING AND ANALYSIS INVESTIGATIONS

G. CHERNOWITZ, Amer. Power Jet Company, *Ridgefield, New Jersey* 07657 (DN890067; N00019-78-C-0073)

Analysis of advanced aviation system concept areas relating to advanced aircraft and weapons systems, support alternatives, cost and effectiveness.

Technical alternatives substantially enhancing naval aviation capability are subjects of individual studies. Each report deals with a major subject area and includes conclusions and recommendations substantiated by the results of quantitative analysis. Techniques include engineering feasibility, system effectiveness and cost assessment and field observation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0015, NONDESTRUCTIVE EVALUATION OF AIRFIELD PAVEMENTS

J.P. NIELSEN, Univ. of New Mexico, U.S.A.F. Civ. Eng. Res. Facil., *Albuquerque, New Mexico* 87106 (102026 (HRB NO.))

A nondestructive vibratory technique is used to evaluate the load-carrying capacity of existing rigid and flexible airfield pavements. A trailer-mounted mobile vibratory unit is assembled for extensive field utilization. Theoretical analysis of layered pavement systems to obtain dispersion curves has been completed. The device has been transferred to Air Force civil engineering for field testing and evaluation of the pavement load rating system developed. A small air-portable nondestructive device is now being developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0016, FABRICATION OF F-14 COMPOSITE MAIN LANDING STRUT DOORS FOR SERVICE EVALUATION

R. CARLSON, Grumman Corporation, *Bethpage, New York* 11714 (DN681284; N62269-75-C-0466)

To demonstrate the service durability and structural reliability of advanced fiber-reinforced composite aircraft structures under actual Navy operational usage. To determine the reproducibility of such structures when produced by a pilot production program and to provide realistic manufacturing cost data which can be used as a basis for future economic projections. This work is in support of work unit ZA101, Aircraft Technology, Agency Accession No. DN681080.

A limited quantity of F-14 composite main landing gear strut doors using pilot production practices and techniques will be fabricated. These composite doors, originally designed and developed under NavAirDevCen contract N62269-74-C-0535, will be installed on current fleet aircraft subjected to a variety of service usages and operating environments. The condition of these doors will be closely monitored periodically over the life of the aircraft. (The service evaluation of the composite doors is not included in the contract.) The manufacturing methods used will simulate large-scale production techniques and the quality of the doors so made will be assessed and manufacturing costs will be monitored closely.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0017, EVALUATION OF DYNAMICALLY INSTALLED INTERFERENCE FIT RIVETS

B. LEFTHERIS, Grumman Corporation, *Bethpage, New York* 11714 (DN881379; N62269-77-C-0478)

To evaluate the fatigue life enhancing and crack growth inhibiting effects of dynamically installed, interference fit rivets and to attempt a theoretical prediction of these effects for use in design analysis. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN 681080.

Both uncracked and precracked riveted joint specimens will be tested using both conventional and dynamically installed rivets. Fatigue life and crack growth rates will be compared. A theoretical prediction of the residual stresses produced by dynamic riveting will be made and linked to stress intensity solutions and crack growth prediction models.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0018, SPARE PARTS FOR F-14A COMPOSITE OVERWING FAIRING

J. MAHAN, Grumman Corporation, *Bethpage, New York* 11714 (DN881337; N62269-77-C-0475)

To fabricate spare parts, kits and equipment required to support the F14 composite overwing fairings during the serviceability evaluation program. This will be accomplished by providing required spare parts, unique to the composite fairings, to operational units as the need arises during the service period of the components.

Five ship sets of composite overwing fairings for the F14A aircraft have been fabricated under a previous contract and are currently awaiting installation on fleet aircraft for a five-year service evaluation study. It is expected that during this period spare parts will be required for these components. The design of the overwing fairing is such that parts common to the production metal fairings are utilized as much as possible on the composite hardware. There are, however, a number of detail parts which are unique to the composite fairing and for which replacement requirements can be expected during the five-year evaluation period. The items to be fabricated under this contract include fiberglass closure fairings, finger panels, installation tools and installation and removal kits. The spare parts will be provided in kit form and packaged in a manner similar to that used for standard F14A spare parts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0019, AIRBORNE VELOCITY SENSOR TECHNOLOGY

H.W. WIMMER, General Electric Company, *Utica, New York* 13502 (DN781338; N62269-76-C-0306)

TECHNICAL OBJECTIVE. The objective of this task is to develop a full function correlation velocity sensor. This work supports work unit ZC801 Agency Accession No. DN 781336.

APPROACH. A development model velocity sensor will be built to measure two dimensions of horizontal velocity, including hover, by the correlation technique. The sensor will be designed to operate over all terrains and water surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0020, ONE-HORSEPOWER MOTOR

G. EGAN, I M C Magnetics Corporation, *Westbury, New York* 11591 (DN881391; N62269-78-C-0397)

To develop motors applicable to the 270VDC power system under development for future naval aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

To investigate the use of newly developed high-energy product samarium cobalt permanent magnets for DC brushless motor designs to achieve desired motor performance characteristics and size and weight comparability with present AC motor designs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0021, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION CONCEPTS FOR NAVAL AIRCRAFT
J. DEMARCHI, Rockwell International Corp., *Columbus, Ohio* 43216 (DN781228; N62269-76-C-0201)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in high-pressure hydraulics, onboard computers, electrical power generation and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. The specific objective of this task is to determine the feasibility of constructing a building block (b-b) actuation concept which uses a localized 8000 psi hydraulic power supply and capable of being controlled electrically. This contract supports work unit ZA101, Agency Accession No. DN681080.

The contractor initially responded to a NavAirDevCen statement of work soliciting competitively advanced flight control actuation concepts. A feasibility study of a 'building block' (B-B) actuator concept was followed by fabrication of two laboratory type B-B actuators. This contract is awarded for the production of system components sized and rated for flight testing on the T-2 aircraft. The contract will be funded on an incremental basis over two years.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0022, MINI-REFRACTIONSONDE
J. ARAKELIAN, Pharos Incorporated, *Upper Darby, Pennsylvania* 19083 (DN781461; N62269-76-C-0508)

TECHNICAL OBJECTIVE. Demonstrate lightweight pressure sensor. This contract supports work unit RG703, Agency Accession No. DN581419.

APPROACH. Provide pressure sensors for use with mini-radio-sonde.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0023, NAVTOLAND SIMULATION COORDINATION
C.J. MAZZA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN781089)

To plan, monitor, and perform, as required, all simulation programs related to NAVTOLAND (Navy Vertical Takeoff and Landing) and to insure that requirements for simulator visual, motion, and computer systems imposed by these programs are met.

Assess various concepts advanced by NAVOTLAND support technologies as they impact simulation facility capabilities. Assess existing simulation facilities in terms of these required capabilities. Develop an integrated plan for simulation facility improvement and NAVTOLAND concept evaluations. Adapt recent ship motion and airwake data for simulation application. Develop suitable simulation math models for VSTOL aircraft and NAVTOLAND concepts. Plan and perform specific concept evaluations identified in the overall simulation plan.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0024, VECTORED ENGINE OVER WING CONCEPT EVALUATION STUDY
P.D. WHITTEN, General Dynamics Corporation, *Fort Worth, Texas* 76101 (DF139880; F33615-77-C-3097)

Maneuver performance improvements continue to be the major emphasis of advanced air combat aircraft studies. Aerodynamic/propulsion synergism, or propulsion-lift, has been previously shown to provide a design alternative which can result in significant payoffs. The vectored engine over wing (VEO-wing) concept offers a propulsion-lift approach which has been verified, through wind-tunnel studies, for near-term fighter application. The objective of this effort is to conduct a study to determine the most cost-effective means for VEO-wing concept demonstration and to further evaluate the performance potential resulting from concept application. Results from this study will provide data for evaluation of the concept for transition to advanced development.

Studies will be conducted to evaluate the vectored engine-over-wing concept potential for application to advanced air combat aircraft and to investigate technology demonstration approaches. Innovative methods, to cost-effectively demonstrate the VEO-wing concept, will be evaluated. Emphasis will be placed upon modification of existing vehicles. Performance evaluations will be conducted for air-to-air and air-to-ground VEO-wing configurations. The concept benefit will be identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, HT SS 78-03 - LOW-RCS SYSTEM CONCEPT INVESTIGATION - ARMY HELICOPTER
UNKNOWN, U.S. Army, Applied Technology Laboratory, *Newport News, Virginia* 23604 (DA0E3822)

Conduct analysis and experimentation to develop an optimum low-RCS shape for application to a helicopter airframe.

Previous RCS reduction investigations indicate significant reduction in RCS signature may be achieved by shaping. This effort will define the shaping for application to the primary structure of a helicopter for future practical evaluation. An analysis will be conducted using ATL RCS prediction methods and data developed from previously conducted fuselage LRCS shaping studies to define an optimum shape. Model and full-size mock-ups will be fabricated for fit, function, and RCS evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0026, HT ST 76-26 - RPV COST AND WEIGHT REDUCTION INVESTIGATION
UNKNOWN, U.S. Army, Applied Technology Laboratory, *Newport News, Virginia* 23604 (DA0E3835)

The technical objective is to determine methods for reducing weight and cost of RPV structural components. Particular emphasis is to be placed on the capabilities of manufacturing structural shapes and attachment points in a cost-effective manner.

Using the basic aquila airframe design, a realistic vehicle structural weight will be selected. Various manufacturing techniques will be evaluated to determine which technique offers the best compromise between lightest weight and longest life. The applicability of these methods will be determined by the fabrication of selected component part of the aquila. Weight and cost comparisons will be made for the various structural concepts.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, GAS GENERATOR FUELS STUDY
J. TYLER, Signal Companies Incorporated, *Los Angeles, California* 90017 (DF190710; F29601-77-C-0074)

Identification of viable alternative(s) to hydrazine for use in gas generators required to drive high-power airborne power units.

Fifteen fuels are to be investigated for possible use in high-power APU systems. The contractor will develop a parameteric

weighting system for selection of candidate fuels. A detailed fuel specification and duty cycle are provided for development of the weighting system. The range of interest is from 3,000 to 20,000 shaft horsepower.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

3.0002, CHEMISORPTION AND CATALYSIS ON SOLID SURFACES USING MOLECULAR MANY-BODY TECHNIQUES

W.A. GODDARD, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DMR74-04965 A03)

It is proposed to carry out quantum mechanical calculations of (1) the electronic states of surfaces, (2) of chemisorption of atoms and molecules onto surfaces, and (3) of the reactions of adsorbed atoms and molecules on surfaces (heterogeneous catalysis). This study will make use of the many-body quantum mechanical techniques developed and applied in the last two years to the study of the electronic states and reaction mechanisms of small molecules (O3, butadiene, etc.). Such techniques seem better geared to answering the important questions about chemisorption and catalysis than the more standard techniques of solid-state physics. The objective is to establish the basic mechanisms involved in chemisorption and heterogeneous catalysis and to develop computational techniques that can provide a detailed understanding of the fundamental processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0003, STRUCTURE DETERMINATION BY ION INDUCED X-RAYS

A.R. KNUDSON, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN880045)

The objective of this work is the study of the solid-state and atomic states of excitation produced in the interaction of ion beams with matter. We wish to determine the characteristics of the states produced and the cross sections for producing such states. The improved understanding of the interaction between energetic particles and matter, resulting from this work, has potential applications in the areas of materials modification, materials analysis, radiation damage, and laser development.

Energetic ion beams are used to bombard selected materials, and the excited atoms produced by the collisions are probed through observation of the radiation emitted in the decay of these states. Spectrometers are available for making high-resolution measurements of the photon spectra from the x-ray region through the visible region.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0004, MATERIAL SUPPORT TECHNOLOGY - OPTICAL DIAGNOSTICS

J.R. MCDONALD, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN880005)

The objective of this program is the development of new, state-of-the-art optical (laser) techniques for diagnostic applications of importance to the Navy. These applications include combustion analysis, such as gases in jet engines, nuclear reactor off-gas monitoring, and gas laser diagnostics.

Tunable and high-power lasers are primary tools for modern diagnostic methods. These techniques include coherent anti-Stokes Raman spectroscopy (CARS) and laser-induced electronic fluorescence (LIEF). These methods are useful for species detection, concentration measurement and temperature determination in various combustion applications, such as jet engine combustor and exhaust analyses, detection of radioactive contaminants and gas laser diagnostics. These novel optical techniques are important because they are able to three-dimensionally probe hostile environments where mechanical probes, such as thermocouples, etc., would be consumed, would disturb the system or give erroneous information.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0005, CHEMICAL CHANGES IN HIGH-TEMPERATURE-STRESSED LUBRICANTS

H. RAVNER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680375)

To improve the capability and maintainability of present and future Navy aircraft by developing more stable lubricant formulations. This will require a better understanding of the chemical processes involved in the degradation of heat and oxygen-stressed lubricant base stocks and additives.

Model ester fomulations will be exposed to very high-temperature environments (225 deg. to 350 deg. C). Reaction products of the base stocks ad additives will be isolated and identified using appropriate instrumental and chemical procedures. From these data the mechanism of base stock and additive inhibition will be postulated, providing the basis for developing more efficient base stock-additive lubricant formulations for Navy aircraft use. NAPTC will provide the engineering back-up required in this work.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0006, FRACTURE IN ADVANCED TRANSPARENT COMPOSITES

S. SUTTON, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN220065)

Characterize the fracture toughness of advanced transparent plastic composites and of their components in laboratory test in order to predict their behavior in aircraft canopies and to provide meaningful simplified quality control and specification test. This will result in increased reliability in service and increased efficiency in design.

Evaluate current techniques and devise new techniques as needed for determining the fracture toughness of plastic glazing materials of current interest, using fracture mechanics concepts. Determine the toughness characteristics of these materials, as a function of specimen geometry, thickness, rate of loading, and temperature. Study the relation between properties of the plastic composites and of their components.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0007, AN ANALYSIS OF THE BENEFICIAL EFFECTS OF MECHANICAL TWINNING ON BOTH STRENGTH AND DUCTILITY OF FACE-CENTERED CUBIC METALS

R.E. REEDHILL, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DMR77-22654)

This is a continuation of a basic study on the role of twinning in the work-hardening of face-centered cubic metallic materials. The objectives of this research are: (1) to extend the analysis of dislocation-twin boundary reactions to anisotropic materials; (2) to examine deformed single crystals and polycrystals by transmission electron microscopy to determine whether barriers exist; (3) to determine the effect of strain rate, temperature, and grain size on the stress-strain behavior of polycrystalline face-centered cubic alloys; and (4) to determine the role of twinning in the work softening behavior of face-centered cubic alloys. In order to ascertain that differences observed between the strain hardening in compression and in tension are caused solely by the effects of twinning, the possible variation in texture with strain will be monitored. In order to properly assess the effects of twinning on strain hardening, the interaction of the twinning phenomenon with the mechanically induced dislocation structure will be studied using transmission electron microscopy. This is a renewal of NSF Grant DMR75-15110. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0008, INVESTIGATION OF THE ELECTROMAGNETIC SHIELDING CHARACTERISTICS OF COMPOSITE STRUCTURES (ABBREV)

G. BECHTOLD, U.S. Navy, Surface Weapons Center, *Silver Spring, Maryland* 20910 (DN785004)

To develop the relationship between the electromagnetic pulse and other shielding (static, lightning, EMI) required for the F18, AV8B, and other future aircraft employing composite structures in a complex electromagnetic environment.

NSWC will provide expertise to NavAir in the field of EMP and other electromagnetic techniques to support studies of electromagnetic shielding properties of composite structures. To develop the techniques required for the effective development of composites NSWC will -a. Monitor NavAir contractors. B. Coordinate with industry, the Air Force, Army, NATC, and the F18 projects. NSWC will also monitor research activities re the F18 projects. NSWC will also monitor research activities related to high-energy effects on composite structures and will conduct tests and analyses on composite materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0009, ELECTRONIC PROPERTIES OF DISORDERED MATERIALS

A. BANSIL, Northeastern University, Graduate School, *Boston, Massachusetts* 02115 (DMR76-80856)

The research to be performed under this grant will focus on the equilibrium electronic properties of disordered metals. The materials to be studied include: noble and transition metal alloys, transition metal hydrides and metallic glasses.

The disordered alloys will be investigated within the framework of the average t-matrix approximation, utilizing realistic muffin-tin potentials to represent the atoms. In recent years, a substantial body of experimental optical, photoemission, de Hass-van Alphen, positron annihilation, specific heat, Hall effect and residual resistivity data on a wide range of transition and noble metal alloys has become available. The extent to which these data can be correlated within the present scheme will be studied.

The theory will also be used to study the electronic spectrum of sub-stoichiometric transition metal hydrides, which have many potential technological applications. The theory will also be extended to the study of liquid metals and metallic glasses.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0010, EXTENSION OF SPIN-POLARIZED TUNNELING TECHNIQUES TO THE STUDY OF FERROMAGNETIC CRYSTALS

R.H. MESERVEY, Mass. Inst. of Technology, Francis Bitter Natl. Mag. Lab., *Cambridge, Massachusetts* 02139 (C670 T. O. 9)

This research will extend the technique of spin-polarized electron tunneling to single crystals and bulk ferromagnetic metals to allow measurements giving fundamental insight into the nature of ferromagnetism in metals. The fabrication of thin (20 A) aluminum tunnel junctions on clean surfaces of single crystals of nickel and other ferromagnets will allow these experiments to be carried out. The measurements with bulk single crystals will be in the regime where theoretical calculations including band structure and surface effects can be applied with considerably more confidence.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0011, NAVY VEHICLE DESIGN AND CONSTRUCTION - RARE-EARTH ADDITIONS TO TITANIUM ALLOYS

C.R. WHITSETT, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DN675493; N00014-76-C-0626)

Titanium alloys are important lightweight structural materials for use in aircraft and ships. Alloy microstructure and mechanical properties can be controlled by effective use of alloying and processing. This research will explore the effects of rare-earth additions to titanium alloys.

Erbium, yttrium and mischmetal will be added to Ti 6-4 and the resulting structure and mechanical properties measured. The role of rare earths as grain refiners, strengtheners, and toughners will be determined. Variables include composition, fabrication and heat treatment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, PHOTOIONIZATION AND PHOTOCONDUCTIVITY IN MOLECULAR MATERIALS

C.L. BRAUN, Dartmouth College, School of Arts & Sciences, *Hanover, New Hampshire* 03755 (DMR77-00318 A01)

The Principal Investigator continues his study of photoionization and photoconduction including work on liquid insulators as well as solids. A more detailed picture of photoionization, geminate charge recombination, and photoconductivity in condensed-phase materials is being developed. There are three principal goals: 1. To determine the primary quantum yield of photoionization for several molecules (e.g., benzene) as a function of excitation wavelength using high electric fields and fluorescence quenching as complementary probes. 2. To use Onsager theory to determine the distribution function of separation distances between just-thermalized electrons and their parent positive ions for a number of solutes, solvents and photon energies. 3. To understand the origins of photoconductivity near threshold energy. Spectroscopic observation of Wannier exciton series will be important in this effort.

This work should have practical significance for the understanding of quantum efficiency limitations of photoconductive devices and organic photovoltaic cells.

This is a continuation of research support under DMR72-03035.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0013, GREASE ANALYSIS

P. SENHOLZI, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696007)

To determine the feasibility and effectiveness of 'grease analysis' as a diagnostic technique.

Develop a grease analysis technique and determine its diagnostic effectiveness through laboratory and field application.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0014, EVALUATION OF THE FUEL/WATER EMULSION CONCEPT FOR SMOKE REDUCTION

A.F. KLARMAN, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN796817)

Determine the effects of a fuel/water emulsion of jet engine fuel control and engine performance. Evaluate the feasibility of using the fuel/water emulsion concept for test cell exhaust stack smoke plume reduction.

A gas turbine engine fuel control will be subjected to a cycle which includes a two hour fuel/water test followed by a purge with clean fuel and a 22 hour 'soak' with clean fuel. This cycle will be run five times. Performance will be monitored and compared to the specification. the control will then be disassembled and inspected and a decision will be reached as to whether it is advisable to continue with the engine test. The same testing cycle will be run five times using a full engine. In addition to monitoring engine performance and comparing the performance to base line values and engine specifications, the engine exhaust pollutants will be monitored at the engine tailpipe with a cruciform probe (CO2), CO, HC, NO sub x, smoke) and with a single-point probe (particulates) and at the test cell exhaust stack (visual opacity). During two one-hour cycles a parametric evaluation of the fuel/water emulsion water concentration will be performed. Upon completion of testing the fuel control will be disassembled and inspected.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0015, DEVELOPMENT OF FT MATERIALS

A.F. ARMINGTON, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF903480)

The objective of this effort is to improve quality of resonator materials. Presently used quartz resonators lack radiation harden-

ing and long-term stability. Fabrication of resonators from this material should result in improved radiation hardening and frequency stability for use in satellites and other Air Force systems.

Crystals of sufficient size for 5 megaherz resonators will be grown by hydrothermal technique using information obtained from JOCAS 2306J104. Purification of quartz by electrolysis will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0016, PROPERTY-STRUCTURE-PROCESSING RELATIONS IN POLYMERIC MATERIALS

G.C. BERRY, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh, Pennsylvania* 15213 (DF049390; AF-AFOSR-3404-77)

AF function - advanced Air Force aircraft and space systems employ structural and containment materials which require superior performance characteristics over a broad range of temperatures, pressures and environmental conditions. Deficiency - the understanding of the interrelationships of process parameters and variations with properties and structure in polymer systems of interest to the Air Force is lacking. Objective - the objective of this research will be to study the kinetics of polymerization of extended, stiff-chain polymers and the rheological properties of polymeric fluids, suspension and solids. How work contributes - this research will contribute to the processing science base for molecular composites and integral fuel tank channel sealants.

The kinetics of the polymerization of 4, 6-diaminoresorcinol with terephthalic acid leading to the 'paracatenated' polybenzoxazole (PBO) will be studied with attention being given to the investigation of effective reactivity of polymer chain end groups as a function of chain length. The rheological behavior of suspensions of particles in Newtonian and non-Newtonian fluids will be established. Systematic studies of branched macromolecules and of two-component, two-phased systems, such as suspensions of hard particles in polymeric fluids will be pursued.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0017, SURFACE REINFORCEMENT OF GAS TURBINE COMPONENTS BY REFRACTOR COATINGS DEPOSITED BY MEANS OF VACUUM PYROLYSIS

S.R. BROWN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN881212)

Utilize vacuum pyrolysis techniques to develop wear, oxidation- and sulfidation-resistant coatings for advanced aircraft propulsion system components, including hot-pressed ceramic and super alloy hot section components.

The advantages of vacuum pyrolytic techniques will be exploited to impregnate and coat thin-walled and holed structures with novel refractory materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0018, SATELLITE STRUCTURE IN X-RAY PHOTOELECTRON SPECTROSCOPY (ESCA)

J.C. CARVER, Texas A & M University System, School of Science, *College Station, Texas* 77843 (A-672)

SUPPORTED BY Robert A. Welch Foundation

3.0019, INTERNAL-STATE ENERGY DISTRIBUTIONS IN THE PRODUCTS OF REACTIONS INVOLVING ELECTRONICALLY EXCITED ATOMS

W.H. BRECKENRIDGE, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (CHE77-07603 A01)

A special apparatus for dynamical studies of the dissipation of energy in collisions of short-lived electronically excited atoms with small molecules is being constructed. Excited atoms will be created by pulses from an excitation laser, and the initial internal-state energy distributions of chemical or energy-transfer products of the collisions of the excited atoms with quencher molecules will be determined by the laser-induced fluorescence technique under essentially collision-free conditions.

Quenching processes of a wide variety of excited atoms and molecular quenchers will be studied with the proposed apparatus. Initial experiments will be concentrating on the quenching of excited states of Li, Be, and Mg by the simplest molecular quenchers: H2, HD, and D2. Such experiments will provide detailed dynamical information which can be subjected to detailed theoretical interpretation due to the relative simplicity of the potential surfaces involved.

This work is a continuation of that currently supported by Foundation grant, CHE 7512851.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AN ANALYTICAL AND NUMERICAL STUDY OF SHOCK WAVE FORMATION

A.R. SEEBASS, Univ. of Arizona, School of Engineering, *Tucson, Arizona* 85721 (DN675087; N00014-76-C-0182)

The ability to predict, accurately, flows with imbedded shock waves is essential for transonic design and optimization. The proposed study will be an analytical and numerical investigation of a nonlinear equation, of the transonic type, to examine the coalescing of waves and the formation of shocks in the interior of the flow.

At very high subsonic speeds a complex flow interaction takes place in the supersonic region imbedded in the flow about the upper surface of an airfoil. Body-generated expansion waves reflect from the sonic line to coalesce and form a shock wave. The nature of this coalescing phenomenon can now be studied only by numerical techniques--techniques which have accuracy limitations, particularly as regards shock location. The purpose of this study will be to attempt to develop an analytical solution which can serve as a basis for improving the presently employed numerical techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0002, ADVANCED SURFACE SINGULARITY TECHNIQUES FOR CALCULATING 3-D POTENTIAL FLOW

J. HESS, McDonnell Douglas Corporation, *Long Beach, California* 90808 (DN881120; N62269-76-C-0377)

To develop advanced singularity techniques for calculating three-dimensional potential flow about arbitrary bodies, and to prepare and deliver a computer program for the calculation. The contract supports work unit NN701, Agency Accession No. DN481077.

Under a previous contract, a computer program was developed at Douglas using panel method. This program requires a large computing cost for complex body comfigurations. In the proposed work, curved surface panels and a variable surface singularity strength will be used in place of flat panels and constant singularity strength used in the previous program.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0003, ADVANCED MISSILE AERO CONTROL INVESTIGATION

M.D. THOMAS, Lgarde Incorporated, *Newport Beach, California* 94304 (DA0G1033; DAAK40 78 C 0072)

The objective of this effort is to investigate the adaptation of a movable aerodynamic flare to present and advanced missile systems in order to compare increases in control effectiveness and maneuverability characteristics.

A conceptual design of the advanced aerodynamic control, adapted to existing Pershing II and Patriot missile systems, shall be accomplished to provide baseline configurations from which performance calculations can be made to determine increases in maneuverability and a reduction in control system weight thus providing a lower systems cost. An open-loop 6 DOF simulation shall be performed to ascertain the performance when comparisons are made between the base line configurations and the existing Pershing and Patriot missiles. A plan for a flight demonstration program to include recommendations as to possible flight test boosters as well as test ranges, costs and other related parameters shall be developed and submitted as part of the final report.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0004, DEVELOPMENT OF LASER PARTICLE ACCELERATORS

R. PANTELL, Stanford University, School of Engineering, *Palo Alto, California* 94305 (EY-76-S-03-0326 042)

The purpose of this program is to investigate the use of lasers for the acceleration of electrons. Lasers can provide higher field strengths than are available in ordinary LINACS, because the latter are limited by breakdown at metallic surfaces. To achieve energy transfer from light to particle over a distance of many wavelengths, the phase velocity of the wave must be retarded to the particle velocity. This can be accomplished by having interaction take place in a gas.

An experiment has been assembled to study this effect, using a 30 MW Nd:YAG laser and the electron beam from the Stanford Superconducting Accelerator. The energy spectrum of the particles with and without the presence of the laser is measured by a 44° mass spectrometer.

The intent of the experimental portion of the program is to observe the dependence of the particle energy on the system variables. Factors that can be changed are the pressure of the gas, the type of gas, the energy of the incident electrons, and the intensity and direction of the laser light.

In parallel with the experiment is an analytical study of the energy exchange process. A model, based upon a Monte Carlo simulation, has been programmed to study the effects of collisions in the gas, beam emittance, and random energy spread of the incident particles. Several different representations for scattering have been used in the model, leading to significantly different amounts of energy exchange. This computer simulation will be used to determine the effects of the presence of beryllium windows in the path of the electrons; to calculate the amount of bunching that occurs; and to evaluate the amount of energy exchange that occurs over a limited interaction length without the presence of the gas.

RESULTS: The electron beam from the superconducting accelerator has been steered through the entire system, although most of the current is lost at the location of a 3 mm diameter beryllium window. It is planned to install a quadrupole focusser to reduce beam interception. The energy spectrum of the electrons after having passed through methane gas and two beryllium windows was measured and the linewidth at 35MeV energy was found to be .1%. An attempt was made to observe any change in the particle energy spectrum with the laser on, but no effect was seen. This measurement was made with an electron pulse duration of one microsecond. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy, Div. of High Energy & Nuclear Physics

4.0005, PARAMETER SENSITIVITY PROBLEMS IN FEEDBACK CONTROL SYSTEMS

N.K. GUPTA, Systems Control Incorporated, *Palo Alto, California* 94306 (DN775271; N00014-77-C-0247)

In many naval control problems, the control design must be insensitive to modelling errors. For example, for controlling aircraft landing on a carrier, the flow field generated by the carrier is not completely understood and so it is necessary for the aircraft to be insensitive to changes over possible flow fields. This is particularly true for automatically controlled carrier landings. This task will develop methodology for the design of simple control laws which are applicable to problems with such parameter uncertainties.

The contractor will develop methods for the design of optimal control laws which are insensitive to system parameter variations. The design methods will include pole and zero placement techniques, linear and nonlinear feedback on past states and inputs and periodic control.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, TURBULENCE AND LARGE-SCALE MOTIONS IN IONIZED GASES

M.S. UBEROI, Univ. of Colorado, School of Engin. & Appl. Sci., *Boulder, Colorado* 80302 (DF042950; AF-AFOSR-2964-76)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, communications as well as countermeasures, demand the fundamental understanding of energy transformation processes occurring in plasmas, specifically turbulence and large scale motions in ionized media. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research program. Objective - this project will investigate the fundamental aspects of turbulence as they apply to high-power, high-efficiency lasers, plasma x-ray sources, heating of turbulent plasma by electromagnetic radiation, ionospheric turbulence and turbulence generated by electron and ion beams. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will investigate the physical mechanisms which drive large-scale motions in plasmas and their effects up on the plasma properties. In particular, it will study the scales or spectra of the motions and their effect upon the transport properties such as diffusion of charged particles and electrical conductivity. Both theoretical and experimental work will be performed. The main objectives to be examined are: (A) The motions caused by electromagnetic effects, specifically 1) in a current-carrying plasma the electromagnetic forces are often rotational and cannot be balanced by potential pressure forces, which leads into eddying motion degenerating into turbulence, 2) in a weakly ionized gas when the current is carried by ions a neutral gas motion is set up. This 'electric wind' can change the current-voltage relation for discharges (especially in multi-electrode). (B) Turbulence generated by instabilities, specifically 1) the case of a positive column in a uniform axial magnetic field, where scales and spectra of electron fluctuations will be investigated and their relation to the plasma transport properties, 2) the case of pulsed discharges where the current sheet becomes unstable and the irregular or turbulent motion produces enhanced diffusion merging with the shock waves. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, FIBER-OPTIC DIGITAL STATUS MONITORING DEVICES

C. BUCZEK, United Technologies Corp., *Hartford, Connecticut* 06108 (DN590214; N00019-77-C-0080)

Development of low-cost fiber-optic digital status monitoring sensors for use in advanced aircraft systems.

Utilizing advanced optical techniques, develop fiber-optic sensors to measure temperature pressure, displacement, fuel level flow rate event counting and strain.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0008, PICOSECOND PHENOMENA 15858-P

J.W. QUINN, Optical Society of Amer. Inc., *Washington, District of Columbia* 20035 (DA0F9160; DAAG29-78-M-0072)

To stimulate the exchange of techniques among the several research disciplines that are concerned with picosecond phenomena. Relevance -the development of picosecond techniques will be useful to Army investigations of short-term phenomena such as compression waves in high density materials, high-speed photography, and fast chemical reactions. It is also possible that similar techniques may be the basis for high-speed electronics and the development of x-ray lasers.

A conference will be organized based on a nucleus of well-known experts in picosecond phenomena research.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0009, APPLICATION OF SYNTHESIS TECHNIQUE FOR NON-LINEAR UNCERTAIN SYSTEMS TO FLIGHT CONTROL OF ADVANCED MISSILES

I. HOROWITZ, Weizmann Institute of Science, *Rehovot, Israel* (DA0D9381; DAERO 78 G0024)

The technical objective of the program is to use a new synthesis technique for solution of the problem of flight control of advanced missile systems.

A new exact synthesis technique has been recently developed for synthesizing nonlinear time-varying feedback systems with uncertain parameters, to satisfy assigned performance specifications. Hitherto, approximate linearizations have been used for this purpose. Application of this new technique to the problem of flight control of an advanced missile system in which there is a very wide operating regime, both in altitude and mach number, will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0010, ACQUISITION OF OCEANOGRAPHIC EQUIPMENT

R.P. DINSMORE, Woods Hole Oceanographic Inst., *Woods Hole, Massachusetts* 02543 (OCE77-23698)

This award will provide improved ship facilities and scientific equipment aboard the research vessels Knorr, Oceanus, and Atlantis II, all operated by the Woods Hole Oceanographic Institution. Included among the items to be acquired are a marine radar system, oceanographic cable, components for satellite communications, an echo sounding system, and certain scientific instrumentation and devices required for the efficient conduct of research activities abroad these ships.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

4.0011, UNSTEADY TRANSONIC FLOW WITH HEAT ADDITION

M. SICHEL, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (ENG76-23982)

Two problems in unsteady transonic flow will be analyzed: 1) to explore the possibility of using similarity series to solve the transonic equations with heating accounting for the existence of shock waves or exothermic discontinuities; 2) to develop a dynamic model of oscillatory condensation for flow where the characteristic reaction or condensation time is much smaller than the characteristic unsteady flow time.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0012, ELECTRONIC WARFARE GSE REQUIREMENTS EVALUATION

A. LEMASTERS, U.S. Navy, Ground Support Equipment Dept., *Lakehurst, New Jersey* 08733 (DN896001)

Maintain efficient technological support of future EW avionics through development of support concepts for ECM systems through the 1980-2000 time frame.

Conduct investigations to determine the future breadth of application and effectiveness of ECM systems and establish a comprehensive plan for the development of a support capability to meet these future needs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0013, INLET CONDITIONS FOR THREE-DIMENSIONAL TRANSONIC COMPRESSOR FLOW

C.E. TREANOR, Calspan Corporation, *Buffalo, New York* 14221 (DN790054; N00019-77-C-0363)

Development of an improved formulation of the inlet conditions of three-dimensional transonic flow through an axial turbomachinery blade row.

Modify linearized three-dimensional theory to include an approximate form of the transonic nonlinearity. Using asymptotic formulae, evaluate the disturbances generated far upstream of a typical transonic blade row, and verify the accuracy of these formulae with at least one numerical evaluation of the modified linear theory. Use these results to develop formulations of the inlet conditions for a three-dimensional transonic rotor. For at least one case, incorporate the above formulations in the three-dimensional nonlinear small disturbance code, in order to make a preliminary assessment of their suitability for numerical purposes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0014, USING MAP KNOWLEDGE FOR IMAGE UNDERSTANDING

C. BROWN, Univ. of Rochester, Graduate School, *Rochester, New York* 14627 (DF714560; F30602-77-C-0050)

The objective of this effort is to apply knowledge gained from maps and preinterpreted images to reduce the amount of computation needed to correctly interpret image data gathered by remote-sensing devices.

The approach that will be followed will be to investigate computer representations of map knowledge and choose an appropriate computer language for this representation. Additional features may have to be added to the chosen language to facilitate this representation. Also, this task will require the investigation of efficient and effective means of segmenting an image into homogeneous regions. This investigation will include an analysis of the use of texture discriminants and their usefulness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0015, ANALYTICAL TECHNIQUES FOR DETERMINING NEAR-FIELD ANTENNA CHARACTERISTICS

W.D. BURNSIDE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DN790023; N00019-77-C-0299)

To develop analytical technique for determining near-field antenna patterns for communication antennas mounted on an aircraft body. A knowledge of the near-field characteristics would significantly improve the present state-of-the-art in designing aircraft antennas, both from the standpoint of performance and expense because the characteristics could be determined more accurately without expensive modeling.

The near-field antenna problem will be initially separated into two parts, a finite flate plate and an elliptic cylinder. Geometric theory of diffraction techniques will be used to determine the Green's functions for such finite shapes. These results will then be combined such that the near field solutions for an elliptic cylinder with attached flat plates can be obtained.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0016, SIMULATION OF THREAT MECHANISMS AND TERMINAL EFFECTS

C.D. CRUZE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF141840)

This effort directly supports AFFDL/FESE test programs. Presently, there exists no launching system concerning conventional munitions capable of facilitating testing of foreign munitions other than the parent weapons. The objective of this pro-

gram involves developing a common launching system to all small caliber foreign munitions and the techniques necessary to simulate their effects against U.S. aircraft. Accompanying the development of the foreign 'kill' mechanisms, efforts will be made to ascertain a means to defeat these threats.

Investigation of propellants will be conducted to ascertain the feasibility of combining powders for the purpose of controlling pressures and burn rates. This technology will be used to establish projectile velocities comparable to that achieved by exploding conventional missile warheads. Planned technological advances will be used to develop a family of weapons that will accept any foreign munition and duplicate the munition effect for test purposes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0017, DEVELOPMENT OF MECHANICAL SYSTEMS FOR EXTENDING TECHNOLOGY OF AERODYNAMIC GROUND TESTING

J.M. HAMPLE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF141570)

The severity and complexity of the effect of the aerodynamic and thermodynamic environments on military vehicles increases as more stringent performance requirements are demanded. Consequently, new materials and configurations must be developed to negate the effect of the new requirements. Aerodynamic test facilities must be continually improved to provide the changing environment in which the performance of these new materials and configurations can be verified in a cost-effective, timely manner. The objectives of this program are to develop and implement new technologies associated with fluid processing systems, mechanical and structural containment, model support and articulation systems, and improving effectiveness, reliability and maintainability of aerodynamic ground-test facilities.

Using in-house capability supplemented by engineering consultation and contracts on specific programs requiring unusual talents, expertise and hardware not available in-house, new techniques and hardware will be evaluated and applied to new and existing systems and facilities. Performance will be measured in terms of cost-effectiveness, manpower requirements and the effect on the environment, as well as applicability to current and anticipated problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0018, AERODYNAMICS OF SUPERSONIC LIFTING BODIES

M.C. JISCHKE, Univ. of Oklahoma, School of Engineering, *Norman, Oklahoma* 73069 (DF050200; AF-AFOSR-3468-77)

AF function - this research contributes to missile aerodynamics R.O. 4.2 and conventional weapons R.O. 6.2. Deficiency - the ability to predict high supersonic flows past vehicle configurations of practical interest is quite limited. The available theoretical methods for analyzing supersonic lifting vehicles are not sufficient to support design and development of efficient low-drag, high-lift configurations. Objective - the purpose of this study is to overcome the limitation of existing theoretical methods to predict performance of vehicles at high supersonic flows. Contribution - this research offers the promise of developing theoretical methods and experimental results that will considerably strengthen current abilities to design vehicle configurations in the high supersonic range that are aerodynamically efficient and can meet demanding maneuverability requirements.

The research into the aerodynamics of supersonic lifting bodies consists of three phases, analytical, numerical and experimental studies. In the first year the analytical studies will develop approximate results for the inviscid flow past elliptical cones and near circular cones. The analytical results will then be used to develop waverider vehicles with integrated inlet designs. The analytical results should also prove valuable in determining how the aerodynamic performance of supersonic lifting bodies can be improved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, EIGENVECTOR MODIFICATION AND MODAL CONTROL

R.P. RHOTEN, Okla. St. Univ., School of Engineering, *Stillwater, Oklahoma* 74074

The focus of the research is on the analysis and synthesis of new control systems for processes modeled by linear, time-invariant differential equations.

SUPPORTED BY Oklahoma State Government

4.0020, ANALYSIS OF CRITICAL MICROSCOPIC FLOW BEHAVIOR

J.L. SWEDLOW, Carnegie Mellon University, Inst. of Technology, *Pittsburgh, Pennsylvania* 15213 (DF051080; AF-AFOSR-3533-78)

AF function - aerospace vehicles with improved durability will substantially improve the Air Force mission effectiveness. Opportunity - progress in mechanics and material science has been made in understanding failure processes. Joint focus of these disciplines can lead to additional significant progress. Objective - the objective of this research is to develop an understanding of micro-scale flow growth in metals which are the basic initiation of macro fracture. How work contributes - research contributes to basic understanding of structural failure of aircraft.

Basic finite-element models will be developed which model the material internal strain and stress field variables. Material distribution will allow for inhomogeneities in the media. Inclusion, voids and defects can thus be idealized. Increasing prescribed strain levels normal to the material surface will allow the growth of plastic strain fields to be studied and the interaction between defect sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, SERVO CONTROLLED RAPID RESPONSE ANTI-G VALVE SYSTEM

R.J. CROSBIE, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN681267)

To determine, by analysis and demonstration, the feasibility of increasing the protective value of the anti-g suit to pilots during rapid-onset high-g profiles by the use of an independently controllable anti-g valve system, and to demonstrate the effectiveness of this system as the only viable method of suit pressurization regardless of the pilot's angle of supination.

A servo controlled rapid response anti-g valve system, compatible for aircraft installation, will be developed and evaluated. Manned studies on the NavAirDevCen centrifuge will determine the time history of increased body pressures caused by body fluid shifts during rapid onset g profiles. The servo controlled anti-g valve system will be programmed to inflate the subject's anti-g suit on a schedule to precisely counteract these fluid shifts. Manned investigations will be conducted on the centrifuge to determine the optimal anti-g suit pressurization schedule for various g profiles. A method will subsequently be developed for automatically controlling the anti-g valve system using aerodynamical derivable signals other than g. Manned tests will also be conducted at various angles of pilot supination.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0022, UNSTEADY AERODYNAMIC FORCES

T. HSIEH, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF421058; F40600-77-C-0003)

Study the approach to determining whether high-angle-of-attack unsteady aerodynamic forces can be isolated and recovered from wind-tunnel test data.

Sources and effects of unsteady flow on wind-tunnel test data will be investigated. Evaluate hardware requirements for unsteady aerodynamic data extraction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0023, DESIGN AND CONTROL OF REMOTE MANIPULATORS
C.C. SMITH, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: Remote manipulators have application in a wide variety of fields, including radiation 'hot box' manipulation, space exploration, industrial automation, undersea exploration/fabrication, etc. Basic factors to be considered in manipulator design include strength, weight, speed and precision of response, etc. These factors are very much influenced by the type and location of actuators used in the design. This study concentrates upon the trade-offs between actuators located in joints and actuators located remote to a joint coupled to the joint via cables, etc. Comparisons will be made on the basis of dynamic response, precision, etc., and various classifications of tasks will be explored.

SUPPORTED BY University of Texas

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, BASIC INVESTIGATION OF REMOTELY DETECTABLE DEPOSITS OF OIL AND GAS (BIRDDOG)
T.J. DONOVAN, U.S. Dept. of The Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9410-01405)

Objectives for the current fiscal year include refinement of computerized enhancement techniques for LANDSAT data and development of similar techniques for color photography to detect alteration aureoles over petroleum deposits. Studies of chemical data gathered through analysis of airborne particulates will continue as will work on the construction of a photo catalog/atlas of alteration phenomena occurring over oil fields.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, PENINSULAR RANGES TECTONICS
V.R. TODD, U.S. Dept. of The Interior, Geological Survey, *San Diego, California* 92037 (9540-01625)

STATE TO WHICH PROJECT PERTAINS: California.

Review and synthesis of existing historic, seismic, geologic, and geodetic records of all faults with known or suspected Late Quaternary activity. 2) Study of satellite and high-altitude (1:90,000 to 1:230,000 scale) photography and other imagery for linear and other structural features that appear to reflect Late Quaternary tectonic activity. 3) Study of known or suspected young faults by intermediate-scale air photos (including low-sun-angle photos) and by detailed geologic mapping. Determination for each active fault of length, width of hazardous zone, distribution and nature of adjacent landslides, character, rate and chronology of past displacements from historic slip events, and Late Quaternary stratigraphic and geomorphic record. 4) Compilation of bedrock geologic maps at scales of 1:24,000 and 1:62,500. Landslides will be mapped by photointerpretation, and consolidated deposits will be classified and mapped.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, SEASAT
D.B. ROSS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8B326348)

PROJECT OBJECTIVE: To verify accuracy and precision of SEASAT satellite measurements of sea surface temperature, wind, and wave conditions and utilize SEASAT-derived geophysical measurements in developing a better understanding of interactions between the ocean and the atmosphere.

CURRENT YEAR PLAN: (1) To install and operate a real aperture imaging radar aboard NOAA aircraft. (2) Initiate modification of existing wave prediction models to be compatible with SEASAT inputs. (3) Continue research on the relationships between remotely sensed surface parameters and described oceanographic measurables.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0004, RESEARCH SATELLITE EXPERIMENT
D.J. WILLIAMS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ42470)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0005, LIGHT AIRCRAFT PHOTOGRAPHY AND MAPPING RESEARCH
R.L. PARKER, U.S. Dept. of The Interior, Geological Survey, *Denver, Colorado* 80225 (9350-00800)

This project seeks to develop techniques of aerial photography using small-format cameras, and of aerial geologic reconnaissance in order to assist geologic mapping and mineral resource investigations. Currently a T-41B is being used to fly 70-mm cameras for both vertical and oblique photography using color and black-and-white films. Projects supported are primarily resource studies in the Rocky Mountain states.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, THE GENERATION AND USE OF CIRRUS CLOUDS AS A TOOL FOR WEATHER MODIFICATION
W.M. GRAY, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80523 (ENV77-10229)

The objective of this research is to explore the feasibility of artificially generating cirrus clouds, to numerically model and observe the influence of cirrus on mesoscale weather, and to study the amount and diurnal variation of natural cirrus clouds to determine whether mesoscale weather modification by artifically produced cirrus is feasible.

The effort consists of an observational research program utilizing infrared data from satellites, data from the Global Atmospheric Research Program Atlantic Tropical Experiment and from the Northwest Pacific, and cirrus cloud versus surface temperature data over the United States. The second portion of the study consists of numerical modeling the effects of cirrus on the troposphere and mesoscale weather using two-and three-dimensional models currently in operation. Possible means of producing cirrus clouds include seeding saturated layers of the upper atmosphere, jet aircraft condensation trails positioned so as to spread throughout cold moist layers of the upper atmosphere, or injecting carbon black into the atmosphere with the heating resulting from solar energy absorption producing the cirrus.

Utilization activities include widespread dissemination of the results to the potential user community, such as various governmental agencies (both Federal and state), commercial cloud seeders, agricultural groups and others.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Environmental Research & Technology

5.0007, OBSERVATIONAL STUDIES OF TROPICAL WEATHER SYSTEMS
W.M. GRAY, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80523 (ATM78-01640)

The objective of this research continues to be the analysis of tropical atmospheric data for theoretical and modelling studies. The goal is to further the understanding of the dynamics of tropical weather systems and cumulus cloud/cyclone-scale interactions. Specific tasks involve extensive use of the data collected during the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) as well as other, less detailed tropical data sets. These tasks include: 1. The analysis and interpretation of tropical clouds for the purpose of modelling their basic features. 2. The study of hurricane and typhoon structure. 3. The study of deep tropical convection by means of satellite data. 4. The analysis of tropical cyclone motions. 5. The development of an upper-air observation composing scheme for extensive tropical data sets.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0008, TROPOSPHERIC-STRATOSPHERIC INTERACTION

UNKNOWN, U.S. Dept. of Commerce, Natl. Meteorological Center, *Washington, District of Columbia* 20023

OBJECTIVE: To investigate the vertical propagation of planetary waves from the troposphere to the stratosphere and to identify periods of significant stratospheric feedback to the troposphere.

STATUS: Harmonic analysis of planetary zonal waves 0-4 has been completed for the 1975-76 and 1976-77 winters, for the heights of pressure surfaces from 700 to 10 mb and for operational satellite stratospheric radiance data. Documentation has been made of quasi-periodic vertically propagating disturbances in wave numbers 1 and 2, and several periods of indicated downward reflection from the stratosphere have been identified. A comparative investigation of the two winters thus far shows much greater wave 2 tropospheric activity in 1976-77, together with a strong tropospheric circulation and stronger meridional heat transports. These factors appear vital for explaining the observed severity of the recent winter.

PLANS FOR FY78: In addition to continued study of the planetary wave-mean flow interaction in these two winters, it is planned to evaluate stratospheric influence on tropospheric forecasting for periods of significant downward lag, including the circulation reversal event of January 1977. A further goal is identification of physical source for wave 2 amplifications in December-January 1976-77, taking into account the observed anomalies of sea surface temperature.

Part 8 of 8.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, National Meteorological Center

5.0009, REMOTE SENSING OF IOWA'S AGRICULTURAL AND FORESTRY RESOURCES

R.E. CARLSON, Iowa State Univ. of Sc. & Tech, Agric. Experiment Station, *Ames, Iowa* 50010 (0064179; IOW01997)

OBJECTIVE: Refine and improve remote sensing-photo interpretation procedures relating to Iowa's natural resources in problems dealing with classification and inventory of agricultural and forest lands and the detection of adverse stresses in these ecosystems.

APPROACH: Standard photo-interpretive procedures and new technology, as available, will be incorporated to extract information from existing and proposed aerial imagery to develop classification schemes to inventory soils, crops, forest land and the extent of diseases in crops and trees at selected test sites in Iowa. It is anticipated that the information extracted at test sites can be extended to areas not physically examined on the ground, but covered by aerial imagery. Basically, we hope to consolidate our expertise from different fields to maximize the information with respect to agriculture available from remote sensors.

SUPPORTED BY Iowa State Government

5.0010, FIELD-ALIGNED CURRENTS IN THE POLAR REGIONS

T.A. POTEMRA, Johns Hopkins University, Applied Physics Laboratory, *Laurel, Maryland* 20810 (ATM76-81211 A01)

This grant will support a program of acquisition, analysis and interpretation of the data obtained from the Navy/Applied Physics Laboratory satellite TRIAD. The TRIAD magnetometer experiment remains the only means of studying field-aligned currents at relatively low satellite altitudes on a continuous basis. The program would establish an automatic data acquisition ground station at Resolute, Canada, and continue the operation of the station at McMurdo, Antarctica. Selected passes of TRIAD magnetometer data from College, Alaska, will be collected for correlation with the radars located at Chatanika and Homer, Alaska, and from Fort Churchill, Canada, and Prince Albert, Canada, for correlation with various ground-based magnetometer chains and radar observations scheduled for the IMS (International Magnetospheric Study). The primary objectives of this study are: (1) To determine the distributions and characteristics of magnetic disturbances (and the related field-aligned currents) in the polar cap and cusp region. (2) To correlate the characteristic field-aligned currents in the polar cap, cusp and auroral region with ionospheric current systems determined from the extensive ground-based observations scheduled for the IMS. (3) To determine the relationship of field-aligned currents with ionospheric scintillations observed to the VHF transmissions from TRIAD. (4) To continue the correlation of the TRIAD magnetometer data with measurements of low-energy electron fluxes from the Atmosphere Explorer C and D satellites.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0011, CELESTIAL ASPECT SYSTEM

R.G. STEEVES, Epsilon Laboratories Inc., *Bedford, Massachusetts* (DF245560; F19628-74-C-0111)

AF function - probing the aerospace environment. Deficiency or opportunity - inability to forecast atmospheric interactions affecting the design and operation of AF systems such as reentry vehicles, over-the-horizon radar, and satellite operations. Objective - to establish methods to control sounding rocket orientation during powered and coasting flight. How research contributes - permits optimum exposure of scientific apparatus carried on sounding rockets to sense aerospace variables and controls trajectory so as to minimize deviation from desired flight plan.

Star sensing system will be developed to provide telemetered celestial attitude to within 0.1 degree. The system is very versatile requiring no vehicle motion up to very perturbed vehicle motion. It will function under day or night conditions. For coasting flight control, a new low-cost celestial aspect system will be upgraded to provide a tracking capability by producing a voltage proportional to the deviation of the stellar image from the desired position in the instrument's field of view. This voltage will be conditioned to control cold gas actuators so as to achieve selected angular orientation of the rocket payload.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, THE LONGITUDINAL VARIABILITY OF EQUATOR SCINTILLATIONS DETERMINED FROM AIRBORNE MEASUREMENTS

J. BUCHAU, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580940)

AF function - communication through the disturbed ionosphere and AFSATCOM. Deficiency - prediction and real-time specification of ionospheric disturbances degrading VHF, UHF and SHF satellite communications. Objective - to investigate the formation, structure and dynamics of equatorial F-layer irregularities, their longitudinal and temporal variability and their effects on satellite communications. How research contributes - payoff is through better predictability of scintillation effects on satellite communications on a global scale and through improved design and operation of satellite communication systems. These improvements are in terms of defining bandwidth and power requirements, modulation techniques, system reliability assessment and operational procedures.

The airborne ionospheric laboratory equipped to receive VHF and UHF satellite transmissions and instrumented for ionosphere and airglow studies will conduct satellite-to-aircraft VHF/UHF scintillation measurements simultaneously on up to four frequencies during a special equatorial campaign. These measurements will be made on coordinated transmissions from the LES 8 and LES 9 satellites (250 mhz) and beacon transmissions from the DNA-002 beacon satellite (137 and 378 mhz). The campaign will be coordinated with ground experiments carried out under Task 464305, Ionospheric Scintillation Effects. All sky photometer observations, spectrometer and photometer measurements, and ionospheric soundings will be carried out during the satellite signal reception and will permit one to assess the relation of the observed scintillations to the geophysical conditions encountered. The satellite field strength data will be analyzed in terms of amplitude and spectral distribution as well as in terms of the fading rate dependence on aircraft heading. The comparison of measurements at various longitudes will provide information on the longitudinal variability of the equatorial scintillations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, REAL-TIME DATA DISPLAY USING COMPUTER TECHNOLOGY
D. DAVENPORT, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF580670)

AF function - pre-flight preparation of sounding rocket and satellite scientific payloads. Deficiency - larger and more complex scientific payloads are currently being developed for flight. Higher PCM bit rates are being used. These factors make payload checkout a long, tedious, and error-prone task when accomplished with currently available PCM equipment. Objective - develop a reliable system for rapid pre-flight evaluation of scientific payload performance. How research contributes - improved payload checkout capability by use of state-of-the-art high-speed digital computer techniques.

A high-speed minicomputer will be used to perform number base conversion and to display scientific information in engineering units. This would allow payload performance evaluation in real time. In addition the system could be easily re-programmed to accommodate a wide variety of PCM bit rates, formats, and specific data display requirements. A hardware interface between the minicomputer and pcm decommutation equipment will be designed and built. This interface will provide synchronization between the computer and the PCM telemetry system. The technical base developed under work units 76590101 and 76590102 will be used to develop new dedicated software both for interface checkout and PCM data manipulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, ANALYSIS OF ATMOSPHERE EXPLORER AND S3-1 DATA
F.A. MARCOS, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF581210)

AF function - airborne surveillance, target acquisition. Deficiency or opportunity - atmospheric density variations with time and space cannot be accurately predicted. Objective - to analyze density results from the AE/S3 accelerometer data base and to relate them to coordinated measurements of composition and other structure properties for the development of an improved atmospheric model. How research contributes - an improved empirical density model will be developed for the altitude region 140-250 km. More accurate density models permit improved surveillance capability and will result in less frequent recalculations by ADCOM of the orbital elements of satellites resulting in a considerable savings in computer costs and improved operational capability.

The accelerometer density data base will be expanded to include all available AE-C, -D, -E and S3-1 data. Correlative composition and temperature data will also be included where available. Studies will be made to determine properties of atmospheric variability related to (a) longitude, (b) geomagnetic activity, and (c) local time. These results will be used to complement and extend the preliminary model developed using AE-C data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, SATELLITE DATA PROCESSING AND ANALYSIS
R.F. FIORETTI, R D P Incorporated, *Waltham, Massachusetts* (DF580540; F19628-76-C-0169)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. Research - direct density measurements with satellite-borne accelerometers. Results are correlated with solar-geophysical parameters and other experiments. How research contributes -permits development of accurate density forecasting techniques.

A MESA accelerometer is on each of three atmosphere explorer satellites. This instrument permits high-accuracy, high-resolution atmospheric density measurements. Telemetry data from all of the experiments on each satellite is stored in a SIGMA-9 computer at NASA/GSFC. The MESA data are accessed using a remote terminal at AFCRL. The raw MESA data consists mainly of drag accelerations which are proportional to density, accelerations due to vehicle spin and nutation and accelerations due to momentum wheel noise and sensor motions. Digital filtering methods are used to determine those accelerations due to drag. Density is calculated directly from the drag data. These results are correlated with those from coordinated experiments to develop accurate models of density variations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, REMOTE SENSING OF NATURAL GAS IN MISSISSIPPIAN-DEVONIAN SHALES
P. JACKSON, Environmental Res. Inst. Mich., *Ann Arbor, Michigan* 48107

Conduct research to develop and evaluate the use of remote sensing in determining the geologic structures conducive to the production of natural gas from the Mississippian-Devonian eastern shales. A flight will be made over a test site surrounding the Cottageville, West Virginia, natural gas field to gather photographic multispectral sensing and synthetic aperture radar (SAR) imagery. These data plus other acquired data such as LANDSAT imagery, gravity, and magnetic will be used to infer geologic conditions such as linears which are conducive to gas formation and production. Computer analysis will then be performed on the data to determine useful procedures.

SUPPORTED BY U.S. Dept. of Energy

5.0017, LANDSAT CAPABILITIES FOR GENERAL WETLANDS MAPPING
B.O. BENN, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (31585)

OBJECTIVE: The overall objective of this study will be to demonstrate the applicability of LANDSAT data to the problem of mapping wetland boundaries and determining general information concerning type and character of wetland areas in the U.S.

APPROACH: A literature review will be conducted to examine previous and ongoing applications of satellite multispectral data to wetlands mapping. Appropriate Corps offices will be contacted to establish the crops wetland data needs from which classes for mapping will be established. Digital image processing techniques will be screened for potential application by reviewing previous work and consideration of the dynamic spectral and spatial characteristics of wetland and upland vegetation constituents. Image processing techniques selected to have the most potential will be evaluated by applying them to selected test areas in both contract and in-house efforts. Wetlands maps prepared from LANDSAT and thermatic type imagery will be compared to established ground-truth data to quantitatively rank the performance of the image processing techniques for mapping the desired wetlands class. Related work currently ongoing at the WES and in support of Corp District or Division offices will be an integral part of this study. A report will be prepared documenting the study and providing guidance or use of those procedures deemed to have the most applicability to acquiring wetlands for Corps' purposes. This work addresses mission problem nos. 1-1-2 and 4-1-24.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0018, IMPROVEMENT OF REMOTE SENSING TECHNOLOGY RESEARCH APPLIED TO LAND RESOURCE ANALYSIS
D.J. BARR, Univ. of Missouri, School of Mines & Metallurgy, *Rolla, Missouri* 65401 (SER77-06848)

The proposed project will provide the instrumentation, graduate student support, and research climate for improving the application of remote sensing technology to the solution of land resource allocation problems. Research into methods of detecting, delineating, and/or monitoring of land use, mineral and energy resource, agricultural, forest and range resources, water resources, reclamation, and environmental quality will be improved and enhanced. Satellite and aircraft image processing

equipment will be procured and integrated into the existing remote sensing laboratory. Graduate research opportunities will be provided along with seminars for exchange of research ideas, problems, and results among researchers from a variety of science and engineering disciplines.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Education Resources Improvement

5.0019, REMOTE SENSING APPLICATIONS TO LAND USE AND NATURAL RESOURCES IN NEW HAMPSHIRE

P.E. BRUNS, Univ. of New Hampshire, Inst. of Nat. & Environ. Rsou., *Durham, New Hampshire* 03824 (0067211; NH00232-S)

OBJECTIVE: Develop a master set of stereograms of forest stands and other natural resource features for the 1974 flight of southern New Hampshire, and other readily available imagery that would act as keys for photo interpreters. Develop aerial volume tables in cubic feet for softwood, hardwood and mixed stands with application to timber stands both local and in northern New England generally. Develop methodology for extracting information on long-term forest land use trends for planning purposes based on successive flights (over time) of aerial photography.

APPROACH: Application of aerial photography to recognition and classification of a variety of forest stands and other land features such as agricultural, cultural, forest, geologic and soils; application of aerial photographic measurement to the evaluation of commercial forest stands as to wood volume, diameter class and stand height; test and further develop classification systems for use on successive flights to determine quantitative data on the extent of changes in forest cover and land use.

PROGRESS: Sequential aerial photography of Dover, N.H., for the 1953-1974 time span yielded information of land use changes meaningful to city planners at a cost of 60-man hours of interpretive work for the 17,800 acre city. LANDSAT data analysis resulted in computer printouts of the Dover, N.H. area delineating broad forest types, wetland areas and the agricultural-open complex, using land cover signatures developed by the project. This work was done under a cooperative agreement with the Dartmouth Remote Sensing Laboratory, utilizing programs and facilities of the Goddard Institute for Space Studies in New York. The total areas in the classifications above are comparable with those obtained from aerial photographic interpretation. Meaningful land use classification systems for use with satallite data will differ from those applied with aerial photography because satellites sense surface reflectances and not land uses. Needed is an operational system to cope with the effect of slope and aspect on reflectance values.

SUPPORTED BY New Hampshire State Government

5.0020, PHENOLOGY, WEATHER, AND CROP YIELDS

B.E. DETHIER, Cornell University, Agric. Experiment Station, *Ithaca, New York* 14850 (0069610; NYC-125426)

OBJECTIVE: Use phenological and mesoscale weather data to understand yield dynamics and improve prediction of yield of selected agricultural crops.

APPROACH: The phenoclimatic models will be developed using mesoscale weather data (supplied by NOAA), phenological data (supplied by NASA). These will be tested against actual yield data and compared with existing solar thermal unit, various growing degree day, the Newman-Purdue and Brown-Ontario models. Remotely sensed data from aircraft and satellite will be studied to determine their usefulness in providing environmental input to crop condition and yield, as an indicator to phenophases of natural vegetation (forest and rangeland) and selected agricultural crops (wheat, corn, alfalfa, soybean, and some grasses) and as a means of quickly determining crop acreage.

PROGRESS: A criteria for evaluating plant simulation models is currently being developed. The criteria consists of indices which utilized important variables in atmospheric physiological processes and phenological events of a plant. The criteria for evaluating simulation models is useful in selecting pertinent plant models which may be applicable to the project. The accuracy and performance of a given model can also be assessed.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, New York

5.0021, DETECTION OF INCIPIENT SALINE SEEPS

L.J. BRUN, North Dakota State University, Agric. Experiment Station, *Fargo, North Dakota* 58103 (0067939; ND04526)

OBJECTIVE: Photographic and thermal imagery will be used to locate existing and potential saline seeps and to monitor changes in saline seep acreage.

APPROACH: Two areas affected by saline seeps will be overflown twice in 1975 and once in 1976 to obtain photographic and thermal imagery. Ground truth surveys will be conducted to delineate saline-seep areas. Survey description will include date, location, land use, soil type, vegetation, presence of salt crusts, electrical conductivity of soil-water extract, earth resistivity measurements and possible interfering imagery. Remote sensing imagery will be correlated with ground-truth data.

PROGRESS: A multispectral scanning and thermal imagery flight of the 22 square-mile study area near Dickinson, N.D. was made on May 19, 1976. A visual seep delineation using 1975 and 1976 color infrared imagery was performed. About 90% of the seeps can be identified compared to those located by ground survey. A stepwise linear regression with seep acreage on a quarter section basis (dependent variable) was compared to parameters found in soil survey reports (slope, texture) and land use. An r-square value of 0.31 was obtained with 12 variables in the model and an n of 88. A quarter section (S 1/2, NE 1/4 and N 1/2; SW 1/4 of section 12, T14ON, R 98W) was selected for intensive study. Gravimetric water content, electrical conductivity, soil texture, land use, relative elevation and earth resistivity were obtained for 392 points located on a 100-foot grid. This data is being correlated for possible identification of distinctive signatures.

SUPPORTED BY North Dakota State Government

5.0022, THE EVALUATION OF WILDLIFE HABITAT ON THE LAKE CARL BLACKWELL LAND-USE AREA UTILIZING ERTS SATELLITE IMAGERY

J.S. BARCLAY, Okla. St. Univ., Graduate School, *Stillwater, Oklahoma* 74075

To determine present and potential quality, extent, and location of vegetative habitats. To survey abundance and distribution of wildlife populations and incorporate wildlife management practices into other land use activities such as grazing.

SUPPORTED BY U.S. Dept. of the Interior

5.0023, SPECIAL FOREIGN CURRENCY AWARD (INCLUDING EGYPTIAN CURRENCY) FOR THE STUDY OF APPLICATION OF REMOTE SENSING TECHNIQUES (ABBREV)

M.A. HADY, Okla. St. Univ., School of Engineering, *Stillwater, Oklahoma* 74074 (INT71-01736 A06)

This proposal details the second phase of a current four-year project which started in Dec. 1975, for the applications of modern remote sensing techniques to regional and national resources development projects in Egypt, under the grant OIP71-01736 A04. Results were published in 15 papers presented in International Conferences, as well as 14 technical reports. The work conducted represents great advances in the applications of LANDSAT and aircraft remote sensing technology to investigation of natural resources, large irrigation, power generation, agriculture projects and environmental studies. Also, basic scientific theories and certain unique problems in the areas of geology, groundwater and soils have evolved.

The second phase program will continue to demonstrate the full utilization of the capabilities of remote sensing techniques, whether from satellites or aircraft, in major development projects in Egypt, apart from the basic scientific research and advancement of the working techniques themselves. Also, special emphasis will be given to the phenomena of desertification and desert development and encroachment on the agricultural areas on the fringes of the Western Desert of Egypt. Full utilization of the newly installed Multispectral Data Analysis System (M-DAS) and the recently acquired high-ceiling Beech King (A-200) aircraft will be achieved.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

5.0024, BRUSHFIELD ANALYSIS OF CLEARCUTS USING MULTI-BAND STEREOSCOPIC AERIAL PHOTOGRAPHY

D.P. PAINE, Oregon State Higher Educ. Sys., School of Forestry, *Corvallis, Oregon* 97331 (0066739; ORE-F-00963)

OBJECTIVE: Investigate the feasibility of brushfield identification as to species composition and density for the purpose of analyzing coniferous regeneration problems using aerial photography.

APPROACH: There are four distinct phases of this proposed research. Phase I will consist of determining the optimum single or multi-band film-filter combinations using inexpensive 2 1/4 x 2 1/4 inch terrestrial photography. Phase II will utilize aerial photography to test one or more of the best film-filter combinations as determined in Phase I at a minimum of two different photo scales. Phase III will consist of obtaining ground truth of the test sites as photographed from the air, both as to brushfield conditions and coniferous regeneration present. Phase IV will consist of developing a sampling system for brushfield inventory--complete with implications as to regeneration survival and potential--coupled with an economic analysis to optimize the system.

PROGRESS: This study has been expanded to include regeneration inventories using aerial photo interpretation, limited field counts and double sampling with regression techniques. The best film-filter-season of the year combination for obtaining seedling counts is standard color film, exposed in early March. On 1:5,000 scale photography we obtained correlation coefficients between field and photo counts of 0.71 for an inexperienced interpreter, and 0.81 and 0.91 for two experienced interpreters. The seedlings were two to four feet high and the brush was not well established. To reduce photography costs a 35mm camera mount was built and installed in a Piper Cub aircraft. Actual photographing is done by a private firm. The best film-filter combination found so far for brush species identification is color infrared film using Wratten 12 and a majenta color correction filter simultaneously. The addition of a blue color correction filter may further enhance interpretation results by further increasing the density of the blue and green emulsion layers of the film. These and other filter combinations will be tested further in March, 1977 for regeneration counts and later on in the year for brush species identification.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Oregon

5.0025, AN INVESTIGATION OF SAMPLING AND DATA ANALYSIS PROBLEMS RELATED TO SATELLITE EXPERIMENTS FOR LONG-TERM RADIATION BALANCE OBSERVATIONS

F.B. HOUSE, Drexel University, School of Science, *Philadelphia, Pennsylvania* 19104 (8-661; 04-6-158-44061)

The investigation involves a continuation of the analysis concerning the optimal sampling by single-axis radiometers on satellites. Now that the methodology for investigating the optimal sampling is on a firm footing, calculations will be performed for NOAA operational orbits to determine the optimal single-axis scanning configuration. Time series analysis of the radiation balance parameters based upon the available Nimbus-6 ERB wide field-of-view data will also be performed using techniques of statistical band-pass filtering. In this manner, the amplitude variation of the dominant frequencies will be explored. A third aspect of this investigation is the continued development of the empirical climate model which will include an ice-albedo feedback and a variable meridional transport of heat which will depend upon the surface temperature configuration. These additions to the model will be analyzed to see how much influence they have when compared to the results prior to their addition in the model. Magnetic tapes containing Nimbus-6 ERB data will be furnished as they were under the previous phases of the grant.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0026, ANALYTICAL EVALUATION OF VEHICLE-BASED FOG COUNTERMEASURES

B.W. KOTH, Franklin Inst. of State of Pa., *Philadelphia, Pennsylvania* 19103 (156790 (HRB NO.))

The objectives of the research are: 1. Determine driver visual requirements for safe driving in the fog environment. Effects of fog on visibility; driver behavior under reduced visibility conditions; scope of fog accident problems; analysis of fog driving scenarios. Provide analytical evaluation of vehicle-based fog countermeasures. Specify fog lamp design and performance parameters. Front-mounted lamps; Rear-mounted lamps; Front/Rear lamp performance interactions; Applications for day/night, roadway types, traffic mix variables.

ADDENDA: Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY U.S. Dept. of Transportation, National Highway Traffic Safety Admin.

5.0027, REMOTE SENSING OF PLANT INJURY BY NEMATODES AND DISEASE ORGANISMS

C.M. HEALD, U.S. Dept. of Agriculture, Agric. Res. Service, *Weslaco, Texas* 78596 (0043997; 7202-20272-001)

OBJECTIVE: Identification of nematodes and other soil pathogens on vegetables, field crops and citrus by remote sensing techniques.

APPROACH: Detect nematode and soil pathogen injury to melons, other cucurbits, cotton, and other vegetables and citrus by IR photography, thermal scans, and other available methods and determine accuracy of such by ground truth data.

PROGRESS:

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research Service, Subtropical Texas Area

5.0028, INFRARED BACKGROUND MEASUREMENTS

D.J. BAKER, Utah Higher Education System, School of Engineering, *Logan, Utah* 84321 (DF249740; F19628-77-C-0203)

AF function - direct support of DOD auroral measurements programs. Deficiency - lack of knowledge of infrared emissions of the atmosphere. How research contributes - measurements of infrared emissions provide information about atmospheric composition and infrared backgrounds. The results of this research are necessary for understanding and predicting the infrared radiation from natural and induced aurora and airglow.

To provide for the conducting of infrared field measurements by sounding rocket, balloon and ground based platforms and is to include-design, fabrication, testing and calibration of infrared sensors, data reduction and analysis, and the folding of these results into existing codes for predictive modeling, and the investigation of new state-of-the-art measurement techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, CCN CLIMATOLOGY STUDY THROUGH REAL-TIME SPECTRUM MEASUREMENTS

V.K. SAXENA, Utah Higher Education System, School of Science, *Salt Lake City, Utah* 84112 (ATM78-03588)

Real-time measurements of the activity spectrum of cloud condensation nuclei (CCN) are required if the CCN climatology is to be properly understood. This requirement is dictated by the fact that the aerosol characteristics keep continually changing with time as a result of atmospheric interactions. Airborne measurements over the U.S. Great Plains during April-May, 1975 revealed that the CCN are formed in situ at the boundaries of the tropopause fold that is a part of the large scale cyclogenesis and occurs during the spring of each year. The resulting tropospheric-stratospheric exchange provides a mixing of the ozone-rich stratospheric air with the moist tropospheric air, thus making available some of the necessary ingredients for the gas-to-particle conversion processes. It is already known that the fold causes the ozone concentration to exceed the Environmental Protection Agency standard on the ground. Under this program real-time measurements will be reduced and analyzed in order to ascertain the strength of this atmospheric CCN source. Basic understanding of

the CCN climatology will further be evolved by estimating the CCN flux from the evaporation of stratus cloud decks, from the land remotely located from populated areas, from farm fires, and from urban-industrial areas. This program will be the first to evaluate the feasibility of using the real-time CCN spectrum measurements for tracing the specific air masses. It will also help evaluate the extent of inadvertent weather modification effects and the relative strength of the natural and anthropogenic CCN sources.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0030, MAGNETIC ANOMALIES FROM SATELLITES
R.D. REGAN, U.S. Dept. of The Interior, Geological Survey, *Herndon, Virginia* 22092 (9780-00371)

The principal objective of this project is the identification and interpretation of magnetic anomalies having geological significance in satellite measurements. Anomalies of such a broad scale could provide information on local, regional, and global crustal structure. Such an analysis of satellite magnetometer data requires development of new analytical techniques that will also have direct application to more standard magnetic surveys, e.g., aeromagnetic data. Such techniques include development and evaluation of geomagnetic field models for use in regional-residual separation; reduction of survey data to a common plane by the equivalent source technique; calculation of magnetic anomalies due to bodies in an inducing field that varies in magnitude and direction; and general problems of the analysis of potential field data on a sphere.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0031, ATMOSPHERIC AND IONOSPHERIC MODELING
E. HYMAN, Science Applications Inc., *McLean, Virginia* 22101 (DN780197; N00173-77-C-0050)

To improve weather forecasts and radio communication reliability.

To develop numerical codes to model the troposphere and stratosphere and to investigate scintillation effects so as to understand UHF satellite data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0032, MEASUREMENT OF TROPOSPHERIC AND STRATOSPHERIC TRACE GASES BY GAS CHROMATOGRAPHY
D.R. CRONN, Washington State University, School of Engineering, *Pullman, Washington* 99163 (R804033-03; G603A-AI-01)

This is one of a multi-part project whose summary may be identical to others.

The objective is to make measurements of the vertical concentration distributions of selected trace gas species in the troposphere and lower stratosphere. Emphasis will be placed on determinations of halocarbons and non-methane hydrocarbons. Determination of the concentrations of the halocarbon species will be accomplished by the methods of electron capture-gas chromatography and gas chromatography-mass spectrometry while gas chromatography with flame ionization detection will be employed for the determination of the hydrocarbons. Samples will be collected by aircraft flights in the United States.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0033, RESEARCH AIRCRAFT OPERATIONS
P.M. POTTER, U.S. Dept. of Energy, Battelle Pacific N.W. Lab., *Richland, Washington* 99352 (0556)

Two aircraft, a Cessna-411 and a Douglas DC-3, have been equipped with tracer release facilities as well as the necessary instrumentation for highly sophisticated measurements of cloud physics, aerosols, pollutant gases, atmospheric tracers, and turbulence. Completion of the interfacing of the VLF Navigational System into the Data Acquisition System of the DC-3 and the installation of the display unit and onboard teletype will provide a data collection system that is extremely flexible for recording a large number of parameters. It will also provide economical recording formats for direct computer input. The DC-3 will be utilized for two types of experiments in support of the MAP3S's Aerosol and Trace Gas Transformation work in St. Louis. It is anticipated that the wind speed and wind direction obtained from the newly installed VLF system will increase the accuracy of the results obtained from these experiments. Aircraft support will be given to precipitation scavenging experiments in the N.E. which are planned for the MAP3S program. Tracer releases into clouds will be made, measurements of pollution distribution entering clouds will be taken, and associated cloud physics and meteorological measurements will be made from the aircraft. The Cessna-411 will be used for continuing Particle Resuspension-Translocation work from forest fires. If funding permits, it may also be used in St. Louis in support of the MAP3S. Additional studies will be conducted on fossil fuel energy plant pollutants and fuel gasification and liquefaction plant pollutants. These depend on other programs' plans, progress and accomplishments.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

5.0034, STUDY OF THE PLANETARY BOUNDARY LAYER DURING THE JASIN EXPERIMENT, USING THE NCAR ELECTRA AIRCRAFT
J.A. BUSINGER, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (ATM77-14934)

The objective of this research is to analyze data collected from an aircraft platform during the Joint Air Sea Interaction Experiment (JASIN). JASIN will occur during the summer of 1978 in the North Atlantic area. The data will consist of air temperature, humidity, wind, long- and short-wave radiation and sea surface temperature. The goal is to use these data to gain a better understanding of convection in the atmospheric boundary layer. This work will be performed in concert with other field programs during JASIN, a regional subprogram of the Global Atmospheric Research Program (GARP). Specific results to be expected from this research include the distribution of momentum, heat and vapor fluxes near the air-ocean interface during disturbed and undisturbed weather conditions and the physical interpretation of those disturbances.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, SUBJECTIVE PERFORMANCE MEASUREMENT
E.L. MARTIN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223710)

To develop a methodology for creating measurement formats which can be used by research and flightline instructor pilots for evaluating pilot performance in flight conditions. The methodology and measurement formats should be applicable across a wide variety of conditions. The measurement formats should meet the same criteria as those applied to automated measurements. A secondary objective is to develop the most reliable and efficient method for training and evaluating the observer's ability to take the required data.

Different types of measurement profiles will be developed for selected UPT T-37 maneuvers including basic and advanced instrument and contact tasks. The candidate types will include the use of an improved rating scale, criterion-referenced parameter assessment, and a combination of the two. These measurement formats will be compared with automated measures. Validation procedures will include the use of stored demonstrations of the selected tasks at specified proficiency levels and recording of live performances. Following determination of optimal manual measurement formats, several training methods will be evaluated using flightline instructor pilots as subjects. The criteria for optimal training methodology are efficiency, accuracy, reliability,

and retention. The resulting methodologies will then be tested on selected Ft4 maneuvers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, DETERMINATION OF VISUAL DATA BASE STANDARDS

E.G. MONROE, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223860)

Requirements for many behavioral research studies necessitate the generation of an environmental data base for ASPT which has previously been developed for another DOD simulation facility but cannot be utilized on the ASPT system due to the incompatibility of the structure and format. The objective of this work unit is to determine a standard for visual data bases using ASPT as a base so that environments may be readily adapted for utilization among the various existing and future CIG visual simulation systems.

Those elements of visual data base modeling which are mandatory to any visual system will be identified. Then those elements of visual data which though not mandatory are used by all present designs will be determined. Finally, those visual systems presently in operation will be investigated to generate a standard data base format which will be compatible to all systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, ISD DECISION TRAINING ANALYSIS

A. LEAL, Perceptronics Incorporated, *Woodland Hills, California* 91364 (DN794004; N61339-77-C-0005)

This project is related to a current NavTraEquipCen 6.2 ISD program to establish the management and technical procedures for implementation of ISD in aviation training programs. The decision training requirements of the SH-2F (lamps) ASW helicopter will be determined, with special attention to the problems of tactical decision making within that system. The methodology to be developed will be generalizable to other systems.

An analysis of lamps operators' functions will be performed using existing task analysis data and instructional course material which is currently being developed. This information will be examined using a decision analytic technique based upon multi-attribute utility theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

6.0004, FEASIBILITY OF DOSIMETER FOR AMINE-BASED FUELS EXPOSURE

M. KLEPER, Abcor Incorporated, *Wilmington, Massachusetts* 01887 (DF320890; F33615-77-C-0618)

Since NIOSH/OSHA standards for occupational exposure to toxic chemicals emphasize time-weighted average exposure, a device for determining such exposure to amine-based propellants is required for Air Force use. Colorimetric dosimeters have been developed but they lack required sensitivity and are subject to interference. Solid sorption procedures are available, but they require air pumps to collect the sample. A simple badge type dosimetric device, small, sensitive and interference-free that can be easily read in the field or alternatively at a central laboratory is desired.

The desired approach to a dosimetric device is the application of diffusion across a semipermeable membrane. Study of appropriate membranes and diffusion parameters for hydrazine, unsymmetrical dimethyl hydrazine and monomethyl hydrazine will be undertaken, emphasizing the effects of ambient temperature, pressure, humidity and air movement. Appropriate detector materials/systems to be used behind the membrane will be selected to afford necessary sensitivity and simplicity of detection. Specificity may be controlled by the membrane, the detector or the measurement method. Several candidate devices will be fabricated for laboratory evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0005, VISUAL DISPLAY INTEGRATION FOR ADVANCED FIGHTER AIRCRAFT

J. WOLF, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DF323690; F33615-77-C-0537)

To provide a systematic definition and assessment of optional visual display design approaches for future tactical fighter aircraft employing advanced technology. During FY 77 this contract will begin (1) a planning and technical framework for a phased, multi-year development and evaluation of cockpit design alternatives, and (2) a series of engineering trade-off comparisons among alternative approaches for visual display integration. This effort is needed because reduced cost dictates smaller size vehicles which reduces panel space for cockpit control/display, as typified by the F-16. At the same time, technology can provide an overwhelming amount of flight data and new flight modes previously unavailable, while cockpit designers lack data on the interaction of new technologies and resulting impact on the crew.

This is the third of three contract efforts (triple award) aimed at developing better methods and criteria for interfacing tactical aircrews within advanced technology fighter aircraft (operational capability post-1985). Visual display design alternatives will be derived based upon mission requirements analyses, crew size/function options, and potential (aircraft, avionic, and display system) technology combinations. Engineering trade-off comparisons among alternatives will determine the impact of specific applications of advanced display technology upon aircrew needs, capabilities and cockpit configurations. Figures of merit used in the trade-off analysis will include performance, safety, survivability and cost. Promising alternative designs may be selected for detailed development and evaluation under a follow-on contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0006, CONTACT AREAS OF THE FACET JOINTS OF THE PRIMATE SPINE

S.P. COMBS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF324210)

To determine the contact areas of the facet joints of rhesus monkey, baboon, and chimpanzee spines. This is to determine the anatomic position (e.g., flexion, extension) of maximum contact of the facet joints which should correspond to the position of maximum load bearing of the facet joints of the spine. The ultimate objective is to determine the position of the spine for maximum load bearing and thereby determine the best position of the spine for the ejection environment.

The cadaver spines of primates will be fitted into a testing jig allowing a multisegmental portion of the spine to be tested under an axial load in various positions (e.g., flexion, extension). Serial photographs will be used to measure the spine's response to the load. three equidistance load cells on a force plate at the bottom of the jig will allow accurate measurement of the load applied and its vector. The spine will then be serially dissected removing muscles, joint capsules and ligaments. The entire specimen will then be stained using a Prussian blue dye. At the end of the experiment, the segments will be disarticulated and the areas of contact measured. The variance of the contact areas can then be correlated with the overall position of the spine. The procedure will be used for five rhesus monkey, baboon, chimpanzee spines. The information obtained will then be used for future experiments of loading of these primate spines and their response to the load.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0007, PREDICTION OF HUMAN PERFORMANCE IN AIR DEFENSE SYSTEMS THROUGH SAINT SIMULATION TECHNIQUES

C.C. JORGENSEN, U.S. Army, Res. Inst., *El Paso, Texas* 79916 (DA644250)

Develop a preliminary system control model of the operator environment in the AN/TSQ-73 missile minder. Explore the integration of hardware and operator functions within the context of the SAINT simulation language. Examine the feasibility of applying system control theory techniques to prediction of operator performance in dynamic systems.

System control theory has proven a useful tool for such separation in the context of the NASA Apollo programs. The separation is performed by generating a particular type of system describing function called a state transfer function. Its role is similar to that of an eigenvalue in a matrix, i.e., one value which contains the sum of the inter-relationships among all the matrix members. The approach, then, is one of using the transfer function to generate that portion of the response data due specifically to the operator as he performs in the tactical environment. The result of such a process would be to create 'pure' human performance data from which more precise human factors studies could be made. This requires major steps as follows: (a) a specific model of the machine/operator must be constructed which realistically reflects the operator behavior; (b) SAINT software must be installed at White Sands Missile Range for expanded usage of available data; (c) performance parameters must be estimated from existing field data; and (d) task analysis data must be reduced to a form compatible with network flow diagrams.

SUPPORTED BY U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences

6.0008 MAINTENANCE SKILLS CERTIFICATION TRAINING PROGRAM ANALYSIS AND VALIDITY STUDIES

J.A. BERGMANN, U.S. Air Force, Human Resources Laboratory, *San Antonio, Texas* 78235 (DF233290)

To provide a task analysis of data to be gathered by a job inventory of WG-8800 employees at the SA/ALC, and conduct a follow-up validation study within the same population. Data analysis results will be used by SA/ALC personnel to design training curriculum, develop training courses, and construct course completion tests as part of the AFLC maintenance certification program.

The aircraft overhaul job inventory will be administered by SA/ALC to approximately 350 aircraft mechanics. Data will be furnished to AFHRL for keypunching and CODAP analysis. Results will be furnished to SA/ALC as they become available. An alternate form of the job inventory will be administered by an alternate procedure to 50 of the original respondents 30 days later to assess the reliability of job inventory methodology in the civilian work force.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0009, BIOMEDICAL LIMITATIONS OF AIRCREWS IN HIGH-PERFORMANCE AIRCRAFT

N.E. LOF, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319760)

This effort will determine the ability of the cardiovascular system to provide adequate organ perfusion throughout the body during exposure to high, sustained acceleration. It has been demonstrated that exposure to operational levels of high, sustained acceleration is associated with cardiac pathology in experimental animals, therefore the coronary circulation will be investigated first. The importance of coronary blood flow and local myocardial hypoxia in the development of acceleration related cardiac pathology will be determined. The physiologic end points at which further acceleration will compromise adequate perfusion of the heart, brain, and kidney will be determined.

Miniature swine and subhuman primates will be used for these studies. The acceleration endpoints at which perfusion becomes inadequate in the various organs will be determined during the first exposure to operational acceleration levels. The same endpoints will be determined in another group of animals which have been conditioned to operational acceleration levels by repetitive exposure to acceleration over a period of 1-6 months. This will provide a data base which can be used to determine the safe limits of acceleration exposure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0010, FIREFIGHTER WORKLOAD FIELD STUDY-ANALYSIS BY TELEMETRY

L.G. MYHRE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323480)

To use the field study approach to realistically evaluate the physiological stresses imposed on USAF firefighters during simulated firefighting operations. Aircraft-related firefighting tasks are unique to military and other aviation related organizations, and there is a need to objectively determine the physiological requirements of these tasks to facilitate the evaluation and development of appropriate life support equipment. Specific objectives of this effort are to determine the workloads associated with various USAF firefighting tasks and to use the data thus obtained for the purpose of evaluating the adequacy of current and future self-contained breathing devices. In addition, USAF firefighting activity may be classified according to the observed work stresses, such a classification may be useful in the appropriate assignment of personnel.

USAFSAM scientists will travel to nearby ALC, TAC, and SAC bases where they will monitor (via telemetry) EKG and body temperature responses to simulated firefighting activities. These data may be used to estimate the energy requirements of USAF firefighters performing selected firefighting tasks, and, thereby serve as a means for evaluating existing self-contained respirators and/or firefighters' protective clothing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0011, PHYSIOLOGICAL INFLUENCES UPON THE WORK PERFORMANCE OF MEN AND WOMEN

G.D. COATES, Old Dominion University, School of Arts & Letters, *Norfolk, Virginia* 23508 (DF050490; AF-AFOSR-3512-78)

AF function - Air Force operations expose aircrew members and other support personnel to a wide variety of environmental stress factors which include fatigue, unusual work cycles, thermal stress, etc. These factors may affect military performance to a degree that would limit an individual's effectiveness in a man/machine system. The results of these studies should provide carefully controlled, quantitative laboratory assessments of women's performance under standard and nonstandard work conditions as a member of the military team. A comparison of data from the proposed study and data already collected on males will provide crucial information concerning any differences between homogenous crews of females as compared to males. Deficiency - as more and more women occupy operational positions, a data base on their physiological capabilities and limitations is required. Objective - this effort will explore the effects of the ovarian cycle and the sex of the subject on work performance. The primary focus of the research is on the effects of ovarian cycling on the work performance of women, including an assessment of the interactive effects of menstruation with a stressor known to produce decrements in work performance, continuous work, and consequent sleep loss. Comparison of the data obtained on female subjects to that of other studies using male subjects employing the same work situation, previously conducted by personnel of this laboratory, will permit some assessment of the effects of sex on work performance as well. How research contributes - this research contributes directly to RO 1.7, 'Aerospace Medicine' and RO 1.5, 'Habitable Crew Environments in Air Force Operations'.

The research will be conducted utilizing the standardized procedures of the synthetic-work approach to performance assessment. It employs a multiple-task performance battery (MTPB) to create within the laboratory a synthetic-work situation in which systematic assessments of work behavior can be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0012, HYPEROXIA - LUNG METABOLISM AND MORPHOLOGY

J.A. WILL, Univ. of Wisconsin, School of Agric. & Life Sci., *Madison, Wisconsin* 53706 (DF051220; AF-AFOSR-3497-78)

AF function - Air Force operating environments expose personnel to a wide variety of environmental stresses and potential

hazards. These stressors are frequently experienced in combination with each other and with other factors such as high human operator work loads and mechanical forces. The use of elevated concentrations of oxygen is probably the most important single factor in the development of atalectasis in pilots of high-performance aircraft. Aviators breathing pure oxygen at reduced pressures are particularly susceptible to absorptional atalectasis and often experience this condition during a breath-hold or when airway obstruction occurs during exposure to acceleration. Exposure of man to pure oxygen even at normal atmospheric pressure rapidly alters lung function and may cause pulmonary damage. Deficiency - USAF research into oxygen use procedures may be highly dependent on the results of this study. The potential complications of chronic oxygen administration to aircrew members is an area that must be investigated. The proposed relationship of biogenic amines to endothelial damage is appropriate. the study should allow the prediction of oxygen toxicity responses that cannot be experimentally measured in man. Objective - the objectives of this program are to 1) define animal models that are similar to man and which produce proliferative endothelium at low levels of hyperoxia as well as exudative lesions at high doses and acute exposure, 2) examine the dynamics of the pulmonary circulation in respect to endothelial function, capillary permeability, and the fate of biogenic amines by determining their transport in the lung and their fate if not removed at a normal rate, 3) examine lung function and the role of chemoreceptor function and possible rebound phenomena in hyperoxia and hyperbaria, 4) correlate function with morphology. How research contributes - this work directly supports subarea 1.5, 'Habitable Crew Environments in Air Force Operations.'

The research will study basic phenomena and their interactions in several species and under various conditions to determine the effects of hyperoxia acutely, with intermittent exposure, and after prolonged exposure. In all cases the functional changes that occur will be correlated with morphologic changes through the use of morphometric techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MATHEMATICAL ANALYSIS/SOLID-STATE SCIENCES

S. WOOLF, Arcon Corporation, *Wakefield, Massachusetts* 48226 (DF902460; F19628-77-C-0051)

Develop for technology transfer computational techniques for specifying on an empirical/numerical/analytical basis ionospheric conditions over the globe placing emphasis on the description of the dynamic behavior of the high-latitude ionosphere in order to make realistic estimates for expected OHD-radar propagation effects associated with ducting in ionospheric channels using ray-tracing techniques. AF function - RF detection at long ranges. Deficiency - lack of capability in early detection. Opportunity - use of non-conventional propagation modes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

7.0002, PERIODIC OPTIMAL CONTROL PROBLEMS

J.L. SPEYER, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: The object of this study is to understand and extend the mathematics involved in periodic optimal control problems. Presently, optimal periodic control theory is a somewhat unexplored field within the framework of optimization theory having important applications. One interesting application, the fuel optimality of airplane cruise is used to help understand the complex nature of cyclic optimization problems. It is found that the steady cruise arc for a large class of aircraft is not minimizing. Attempts to solve this problem using standard numerical techniques have not been satisfying, since these classes of problems are characterized by such mathematical pathology as conjugate points and singular surfaces.

SUPPORTED BY University of Texas

7.0003, NUMERICAL ANALYSIS OF FLOW IN CONNECTING PASSAGE BETWEEN FAN SECTION AND HIGH PRESSURE SECTION OF A TURBOJET ENGINE

A.L. GOLDMAN, Texas Tech University, Graduate School, *Lubbock, Texas* 79409 (DF051600; AF-AFOSR-3561-78)

AF function - advanced turbomachinery. Opportunity - improve calculation methods for flow fields within passageways of arbitrary geometries. Objective - develop a numerical method which may be used to investigate the flow field in an arbitrarily shaped channel in a jet engine. How work contributes - will provide a more efficient method for determining flow geometries and operating conditions within a jet engine passageway.

The general method used for obtaining the flow field will be to finite difference the appropriate equations, with the program of work requiring the successful completion of four tasks. The first task will be to determine which are the appropriate equations to use. Task two will be to construct a coordinate system which may be used with arbitrary channel geometries. The third task will be to model the Reynolds stresses arising from the turbulent flow. Finally, the last task is to solve this set of equations. Solutions will be obtained for both a 2-D and an axisymmetric model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, PHASE TRANSITIONS AND DISORDER IN SOLIDS BY LIGHT SCATTERING

S. USHIODA, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (DMR77-10083 A01)

Structural phase transitions and disorder in solids will be investigated by means of Raman and Brillouin scattering. The systems to be studied are superionic conductors, organic charge transfer solids and perovskite ferroelectrics. Superionic conductors are translationally disordered and some of the organic charge transfer compounds are orientationally disordered. The study will focus on the liquid-like nature and the phase transitions of these systems. In perovskite ferroelectrics, the main interest will be in the anharmonicity of the soft modes and its relation to the structural phase transitions.

Research previously supported by DMR 73-02480.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0002, MATERIAL SUPPORT TECHNOLOGY - TUNNELLING INVESTIGATION OF QUASI-ONE-DIMENSIONAL MATERIALS

P.M. CHAIKIN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DN675684; N00014-76-C-1078)

The Navy has need for new electronic materials that offer improved performance in operational systems. This program will provide needed information on the electronic properties of a class of materials that holds promise for such increased capabilities in communications and surveillance.

The investigator will use electron tunnelling to investigate a series of quasi-one-dimensional materials of considerable current interest. These materials fall into the categories of polysulfur nitride, the charge transfer salts based on tetracyano-quinodimenthane (TCNQ), and metallo-organic salts based upon platinum cyanide (KCP). All have unusually anisotropic electronic and vibrational properties and undergo phase transitions at low temperatures that are associated with Peierl's distortions. Studies in polysulfur nitride will focus on the temperature-dependence of the superconducting energy gap while those in the TCNQ salts will initially focus on the phase transition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0003, ACQUISITION OF EQUIPMENT FOR NEUTRAL PARTICLE PRODUCTION IN HIGH-ENERGY ELECTRON-POSITRON COLLISIONS

C.W. PECK, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (PHY75-22980 A01)

An experiment to measure the neutral states of matter produced in electron-positron annihilations will be conducted using a hemispherical array of NaI crystal detectors. The effort, to be performed in collaboration with other research groups from Stanford, Princeton, Harvard and the Stanford Linear Accelerator Center will be performed at the SLAC SPEAR storage ring facility. Information which is expected to be obtained will shed light on the quark structure of matter, particularly that involving the fourth or charm quark.

This is a continuation of NSF grant PHY75-22980.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0004, MEASUREMENT OF ATOMIC TRANSITION PROBABILITIES

W. WHALING, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-81607 A01)

This research program will be concerned with measuring atomic transition probabilities useful for the quantitative analysis of hot gases and plasmas. The transition probabilities for various atomic species can be measured by (1) beam-foil time-of-flight-measurements of the radiative lifetime of a level, followed by (2) branching ratio measurements to apportion the total transition probability among the individual transitions by which the level decays.

Transitions to be studied will be those that are prominent in astrophysical spectra. For neutral and singly charged ions, the experimental procedure includes a comparison with solar measurements to test the internal consistency of the measured transition probabilities. There will be measurements on the resonance lines of doubly-ionized iron, and the ultraviolet spectrometer will be used to measure transition probabilities for other prominent lines in the wavelength region of 1200-2000 angstroms. Studies of transitions important for ground-based astronomy will deal with cobalt, samarium, and vanadium.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

8.0005, LOW-RESISTIVITY HIGH-LIFETIME SINGLE CRYSTAL SILICON INVESTIGATIONS

P. STELLA, Spectrolab Incorporated, *San Fernando, California* 91342 (DF461400; F33615-77-C-2045)

The objective of this program is to improve N plus/P silicon solar cell performance through the improvement of moderate- to low-resistivity single crystal silicon material.

Reduce levels of non-desirable impurities (Fe, C, Ni,...) in single crystal silicon, establish methods to introduce pure electrical dopants (both in bulk and PP (plus) and N (plus)/P junctions), and fabricate and test cells.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

8.0006, MAGNETIC PROPERTIES OF LITHIUM FERRITE 15242-EL

C.E. PATTON, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80523 (DA0F9069; DAAG29-77-G-0209)

To investigate fundamental properties of titanium-, zinc-, cobalt-and manganese-substituted lithium ferrite microwave materials. Relevance - direct and potential application in military electronic systems such as in Patriot, Firefinder and remotely piloted vehicles.

The relation will be analyzed between magnetic order, magnetocrystalline anisotropy, magnetostriction, grain size, stress and temperature in ferrites supplied by U.S. Army Electronics Command and commercial firms.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0007, III-V SEMICONDUCTOR INTERFACES EFFECTS RE NAVY MICROWAVE AMPS

J.R. SITES, Colorado State University, School of Science, *Fort Collins, Colorado* 80523 (DN675610; N00014-76-C-0976)

This work seeks to determine the cause for various deleterious effects at semiconductor interfaces contemplated for use in Navy microwave amplifiers. It further seeks new material and methods for encapsulating III-V semiconductors.

Systematic investigations using capacitance versus voltage, transconductance, mobility versus temperature, photoconductivity, and photoelectromagnetic effects will be used to characterize the interface properties. Neutral ion beam sputtering techniques will be used to deposit various insulators.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0008, MEASUREMENT OF THE ELASTIC FORM FACTORS OF HELIUM 3 AND HELIUM 4

B.T. CHERTOK, Amer. University, School of Arts & Sciences, *Washington, District of Columbia* 20016 (PHY78-09378)

This experiment will measure the elastic electron scattering cross section from 3He and 4He at ten values of momentum transfer, q2, in the range 0.8 less than or equal to q2 less than or equal to 4 GeV2 at the Stanford Linear Accelerator Center.

The momentum transfer spans the range between traditional nuclear physics on the low end where electron scattering is interpreted as a probe of the charge distribution of nucleons in the nucleus to the high end where the point-like quark constituents of the nucleons may determine the form factor. This investigation follows the measurement by the same group of the deep structure of the deuteron, in 1974, using the same technique of high-energy elastic electron scattering. The deuteron experiment has given the first evidence that this elementary atomic nucleus of one neutron and one proton may be composed of six point-like quarks at very small distances. The helium measurements could confirm the smooth transition of matter from nucleons to quarks constituents as observed in deuterium and therapy provide a significant link between nuclear structure physics and high-energy particle physics. Thus the purpose of this new investigation is to see whether the simple features observed in that earlier experiment are visible in the helium nuclei and are therefore conceivably a general property of matter.

This work is a continuation of that currently supported by Foundation grant PHY75-15986.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0009, ATOMIC DATA FOR HIGHLY IONIZED SPECIES

W.C. MARTIN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2320112)

OBJECTIVE: To obtain atomic data and develop measurement techniques for applications to CTR, UV Laser Research, Space Astrophysics, etc. Measure and analyze spectra to get wavelengths, energy levels, and line identifications for selected ions in group of 5 to 40 times ionized metals of CTR interest. Develop theoretical techniques needed for analysis of high-ionization spectra.

APPROACH: The approach emphasized development of techniques essential for NBS maintenance of its leadership in measurements in the vacuum UV region of increasing technological importance. Highly ionized spectra are obtained with vacuum sparks and from plasmas generated by focussed high-power laser pulses. Differences in these spectra distinguishable with HE 10.7-M spectrographs are used to help separate spectra from different ions states. Regularities along isoelectronic sequences are developed and used in the theoretical analysis.

ACCOMPLISHMENTS: In a collaboration with NRL and LASL workers, we measured and identified the main spectral lines of 30 and 31 times ionized Mo. These ions are very important in CTR plasmas and are among the highest ion stages identified by optical spectroscopy.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0010, MOLECULAR DYNAMICS STUDIES IN SOLIDS
D.H. TSAI, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2215146)

PROJECT OBJECTIVE: To conduct molecular dynamical studies of transport of energy in models of solids and liquids under highly transient and anharmonic conditions. Of special interest are models of solids with an arbitrary number of defects, the role of defects in melting, and the energy relaxation processes in a liquid under shock compression.

PROJECT APPROACH: Molecular dynamics is used to provide a detailed description of the process of energy transport in a liquid subjected to shock compression. This approach is necessary because we do not have a more concise theoretical language at this time to treat highly anharmonic, non-stationary and non-equilibrium phenomena. The atomic motion will be monitored to elucidate the mechanism of stress and structural relaxation, the path of energy flow, etc., leading eventually to a better understanding of such problems as the mechanism of melting and of nucleation, fracture, detonation and other related transient phenomena.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0011, MATERIAL PROPERTIES AND PHENOMENA AT VERY LOW TEMPERATURES
J.B. KETTERSON, Northwestern University, School of Arts & Sciences, *Evanston, Illinois* 60201 (DMR78-11771)

This is a continuation of work sponsored under DMR-7621370. An experimental study will be made of the properties of helium-3 and nuclear ordering in solid helium-3. A nuclear cooling cryostat will be constructed and longitudinal and transverse sound characteristics will be studied in superfluid helium-3. The magnetic properties of solid helium-3 will be examined. Sound propagation studies of liquid crystals will be continued. Transition metals will be examined at ultra-low temperatures for the existence of superconductivity. This work is important for understanding quantum solids and fluids and the low-temperature behavior of metals and liquid crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0012, THEORY OF PULSAR ATMOSPHERES
E.A. JACKSON, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801

One of the exciting discoveries in astronomy during the past decade has been the existence of roughly 150 pulsars, which are stars which exhibit rapid, large-scale, periodic oscillations in their radiation. The pulsars are believed to be very dense (neutron) stars which have an intense magnetic field that rotates with the star. Associated with such a rotating field is a large electric field which can accelerate charged particles to high energies, producing the observed periodic radiation by a 'Lighthouse' effect. To confirm the neutron star hypothesis and explain the variety of observations, a theory is required for the plasma (ionized gas) atmosphere about such a star. This new type of stellar atmosphere, which is quite different than, for example, the sun's, can also occur in many other rotation magnetic stars which are not pulsars, and therefore may have much wider implications.

SUPPORTED BY University of Illinois

8.0013, QUANTUM LIQUIDS
C.J. PETHICK, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DMR76-24011 A01)

Fundamental studies in the theory of quantum liquids, the elementary excitation spectrum of liquid helium (helium-3, helium-4, and mixtures of helium-3 in helium-4), the transport properties of both normal and superfluid helium-3, and the relaxation processes in superconductors will be carried out. The research includes microscopic calculations of both thermodynamic properties and transport phenomena in plasmas, solids and quantum liquids.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, DEEP LEVELS IN SILICON
B.G. STREETMAN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DMR77-22228)

In this research deep level impurities and defects in silicon will be studied using low temperature photoluminescence and optical absorption, photoluminescence excitation spectroscopy, and deep level transient spectroscopy (DLTS). This combination of optical and electrical measurements will be applied to study deep level impurities such as indium and gallium in silicon, and defects resulting from electron irradiation and ion implantation. Ion implantation will be used for controlled impurity introduction and for defect studies. The impurities studied in this research are important in the fabrication of optoelectronic devices, and the defects studied often determine the quality and reliability of electronic devices.

This is a renewal of NSF Grant DMR-7302359 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0015, INFRARED IMAGING AND SPECTROSCOPY OF THE ELECTRON-HOLE LIQUID IN GERMANIUM
J.P. WOLFE, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (DMR77-11672)

An experimental program will be initiated to investigate the electron-hole condensate in optically excited semiconductors at low temperatures. This program includes the development of a versatile micro-computer based system and its application to high sensitivity optical luminescence studies including the enhancement and analysis of infrared images of electron-hole drops in germanium.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, A THEORETICAL STUDY OF NUCLEAR STRUCTURE AND INTERMEDIATE-ENERGY NUCLEAR REACTIONS
J.T. LONDERGAN, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (PHY77-07656 A01)

Research in theoretical nuclear physics initiated under NSF grant PHY75-07803 A01 will be continued. Topics to be investigated include: I. Electromagnetic Interactions. A) Theory of the (gamma, N) interaction at medium energies (Londergan, Nixon), B) Formulation and investigation of intermediate isobar production in (e,electron) and (e,electron p) (Londergan, Walker, Conte). II. Nucleon-Nucleus Interactions. A) Continuation of ongoing program in (p,p), (P,2p) and (p,d) reactions with emphasis on interpretation of new data and model studies of two-step processes, (Walker, Picklesimer). B) Field theoretic and multiple scattering formalisms (Londergan, Weiss). III. Pion Physics. A) Microscopic field theoretic pion-bound nucleon and pion-nucleus formalism (Walker). B) Pion-nucleus quasi-elastic scattering (Walker). C) Study of the pion-nucleon inverse problem with isobars (Londergan). IV. Weak Interactions. Muon production by medium-energy protons (Walker, Weiss). V. Kaon-Nucleus Interactions. The K ion probe as a tool for studying nuclear structure with emphasis on inelastic scattering and knockout reactions (Walker). VI. Heavy Ion Physics. VII. Nuclear Structure.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0017, ULTRASONIC AND RELATED INVESTIGATIONS OF AMORPHOUS SOLIDS AND OF TRANSITION METAL OXIDE CRYSTALS
R.J. SLADEK, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR77-08476 A01)

Ultrasonic, thermal expansion and electrical resistivity measurements of amorphous solids will be carried out. The thermal expansivity of amorphous As2S3 and As2Se3 at low temperatures and the influence of pressure on the velocities of ultrasonic waves near room temperature will be investigated in order to determine how atomic tunneling and acoustic vibrational modes contribute to the anharmonicity of nontetrahedrally bonded glasses.

Also, the ultrasonic attenuation and electrical resistivity are to be investigated in single crystal samples of (Ti1-x Vx)203 down to low temperatures in order to elucidate the role of electrons or holes in band states and in localized magnetic states.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, SURFACE CRYSTALLOGRAPHY AND SURFACE THERMAL PROPERTIES USING RUTHERFORD BACKSCATTERING AND LOW-ENERGY ELECTRON DIFFRACTION

W.N. UNERTL, Univ. of Maine, Graduate School, *Orono, Maine* 04473 (DMR77-28543)

This is a basic investigation of structural and thermal properties of the crystal surface of Pt and Ni, using both Rutherford backscattering and low energy electron diffraction techniques. The objectives of this study are threefold: (1) to gain insight into the relationship between surface crystallography, interatomic force constants, and their deviations from bulk behavior; (2) to advance technique development for surface structure determination; and (3) to develop new methods to investigate the nature of surface defects and disorder. The experiments are designed to yield quantitative information about surface defect structure, including stepped surfaces, and to provide new insight into microscopic processes at solid surfaces. The experiments will be performed at the Rutherford backscattering/low-energy electron diffraction facility at the Canadian Chalk River Nuclear Laboratories.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0019, ELEMENTARY PARTICLE THEORY AND QUANTUM FIELD THEORY

O.W. GREENBERG, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY76-16562 A02)

Work is proposed in several areas of elementary particle theory. Among the subjects which will be studied are: spontaneous symmetry breaking in SU(4)4, 'naturalness' of atomic parity conservation within left-right symmetric theories, excitation of color degrees of freedom, astrophysical implications of present developments in elementary particle physics, and properties of bound states in relativistic quantum field theories.

This work is a continuation of that currently supported under NSF grant PHY76-16562 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0020, PLASMA HEATING, LIGHT SCATTERING AND SPECTROSCOPY

H.R. GRIEM, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY78-00973)

Research will continue, directed on various problems in plasma turbulence and in thermal fluctuatins of dense equilibrium plasmas, with special emphasis on diagnostics. These problems are of a basic nature and have a number of applications to other fields, ranging from astronomy to magnetic and inertial fusion research.

This work represents a continuation of that currently supported by Foundation grant PHY76-24454.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0021, CONDUCTION ELECTRONS AND MAGNETISM

R.E. PRANGE, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DMR77-08602 A01)

A fluctuating local band picture of itinerant ferromagnetism (primarily applying to iron, nickel and cobalt) has been developed and will be extended. In this picture it is recognized that band structure depends mainly on short-range order, and is established on a time scale short in comparison with that characteristic of the long wavelength magnetization fluctuations. The band structure is essential to account for the many measured properties of the electrons which are itinerant. The magnetization fluctuations are, however, responsible for the main features of the thermodynamics formerly attributed to local magnetic electrons. A given random magnetization fluctuation is assumed, the band structure is calculated in its presence by use of an appropriate coordinate system and perturbation theory, and only then can an average over the magnetization fluctuations be made. In this way a version of Fermi-liquid theory valid even above the Curie temperature can be derived. The effect of thermal spin fluctuations on magnons excited by neutrons has been studied and a study of the thermodynamics of the phase transition will be made. Some new experimental data will be analyzed in terms of the fluctuating band picture. The theory of electron-magnon interactions will be further developed and the role of projection operators in the fluctuating magnetization will be investigated, as will the Ruderman-Kittel mechanism for the description of impurity-impurity interactions. The relationship of these models to amorphous magnetic systems will be investigated.

This is a continuation of research supported under NSF grant 0DMR75-13911/A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0022, SUPERCONDUCTIVITY AND FAR-INFRARED STUDIES OF SOLIDS

M. TINKHAM, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DMR76-11323 A02)

This extension of work carried out under grant DMR72-03060 from the NSF is part of a broad program of research on superconductivity. The focus has shifted somewhat from fluctuation effects near Tc to the study of non-equilibrium superconductivity. Experiments are planned to probe the kinetics of the relaxation processes operative in the presence of various types of perturbations. For example, the step structure of I-V curves of superconducting microbridges has been explained by this group in terms of localized quantum phase-slip centers, in which the phase slip rate and hence the voltage is determined by the distance nonequilibrium quasiparticles diffuse before relaxing by phonon emission. Tunneling experiments are planned to give energy-resolved and spatially-resolved information about the disequilibrium near such a center to explore this fundamental resistive process in superconductors. Preliminary measurements of the effect of a magnetic field on these centers will be extended with the aim of exploring the transition from the present regime dominated by the electron-phonon relaxation time to one presumably dominated by the Ginzburg-Landau time, as would be expected for a gapless superconductor. Experiments in which the disequilibrium is produced by laser irradition will be undertaken. Far-infrared lasers can selectively generate excess quasiparticles just above the gap energy, to produce a relatively simple starting point for the study of relaxation processes. Experimental and theoretical investigations of the laser-induced resistive intermediate state will be carried out to learn whether in fact a spatially inhomogeneous state forms spontaneously even for uniform irradiation.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0023, SURFACE EFFECTS IN THE PLASTICITY OF CRYSTALLINE SOLIDS

R.M. LATANISION, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DMR78-05935)

It is known that the mechanical behavior of a solid may be affected by conditions at its surface. In the case of semiconductors and insulators, the influence of variations in the space charge distribution on the mobility of dislocations has been proposed as an explanation for mechanical effects. The principal objective of the present program is to study the effect of changes in the space charge distribution on dislocation mobility about hardness im-

pressions in cadmium sulfide surfaces exposed to sub-bandgap illumination in order to achieve the flat-band condition as determined by surface photovoltage spectroscopy. A singular feature of this program, particularly with respect to the role of surface charge, is the introduction of a surface analytical approach into an area that has been studied historically by essentially metallurgical methods. The microhardness and dislocation mobility (by etch putting techniques) will be determined for a variety of surface conditions. In addition the effect of adsorbed gases on surface mechanical behavior will be studied. Theoretical calculations of the forces between adjacent, like-charged dislocations will be performed to aid in the interpretation of experimental results.

This is a continuation of studies initiated under NSF grant DMR76-06854.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0024, ELECTRONS IN COMPLEX SOLIDS

D.J. SELLMYER, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (DMR78-10781)

The object of this research is the investigation of electronic and magnetic states in relatively complex solids. These materials either exhibit new types of physical phenomena or require new theoretical models for their understanding. Several classes of problems will be studied: (1) electronic structure of d and f band metallic compounds, (2) electronic and magnetic states in limited dimensionality conductors, and (3) electronic and magnetic states in metallic glasses.

The experimental work will consist of high-field magnetoresistance and quantum oscillatory measurements in fields up to 220 KOe. In systems where electronically driven or magnetic phase transitions are involved, electron transport, magnetic susceptibility, and high-field magnetization measurements will be performed.

The results should contribute to our understanding of (1) the relationship between electronic structure and magnetic, structural, and superconducting phase transitions, (2) the relationship between electronic structure and chemical bonding in structures where the bonding is poorly understood, (3) the localized-moment and itinerant-electron aspects of magnetism in conducting solids, (4) the electronic structure and electron-transport properties of intertransition-metal amorphous alloys, and (5) the dependence of the magnetic properties of glassy metals on fluctuations of exchange constants, local random anisotropy, charge transfer, and structural effects.

This research was previously supported under DMR-7617417. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, THEORETICAL NUCLEAR PHYSICS

L. ZAMICK, Rutgers The State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (PHY77-00478 A01)

Theoretical research initiated under Grant PHY75-06858-A01 will be continued. Topics in theoretical nuclear physics to be investigated include: Aram Mekjian: 1. Muon capture in nuclei; 2. Isobaric analog resonances; 3. Photonuclear reactions; 4. Inelastic electron scattering; 5. Heavy ion scattering. Larry Zamick: 1. Collective theories of giant resonance states; 2. Effective charge with and without scaling; 3. Isoscalar magnetic moments; Nuclear compressibility and isotope shift; 5. Hartree-Fock theory for a closed shell plus one nucleon; 6. Coulomb energy differences and radii.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0026, EXPERIMENTAL AND THEORETICAL STUDIES ON THE PHYSICS OF BIOLOGICAL MOLECULES

J.J. HOPFIELD, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (DMR78-05916)

This research is aimed at an understanding of how biological molecules, assemblies, and systems operate from a physical and quantitative viewpoint. Currently under study are electron transfer proteins and assemblies (where an understanding of the mechanism of electron transfer and its relation to molecular structure and environment are sought), hemoglobin (where the mechanism by which the global structure affects local chemical properties is investigated), and accuracy problems and mechanisms in biosynthesis. The work is a closely integrated combination of experiment and theory, as in the electron transfer studies. The theoretical description of vibronically coupled electron tunneling transfer is now being tested by studying a charge transfer band described by the theory. The band is three orders of magnitude weaker than any previously studied. This experimental study is capable of providing a complete test of the concepts, constructs, and parameters of the theory. With an understanding of the mechanism of reaction, an approach to understanding some of the physical problems of photosynthesis and oxidative modulation spectroscopy.

This is a continuation of research supported under DMR 75-14264.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0027, THEORETICAL SOLID-STATE PHYSICS

J.L. BIRMAN, City University of New York, School of Arts & Sciences, *New York, New York* 10031 (DMR78-12399)

Research previously supported by DMR76-20641.

Theoretical research in condensed matter physics will be carried out. The topics to be investigated will include: (1) novel applications of group theory; (2) optical properties of condensed matter, including resonant inelastic light scattering and optical properties in non-local media and surfaces; (3) anomalous electronic properties and structural phase transitions in A-15 superconducting alloys; (4) the 'inverse' periodic potential problem; (5) lattice dynamics of diamond, graphite, cuprous oxide and related compounds; and (6) optical and electronic properties of tetrahedral amorphous semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, ELECTRONIC STRUCTURE OF HIGH-TEMPERATURE SUPERCONDUCTORS

S.J. WILLIAMSON, New York University, School of Arts & Sciences, *New York, New York* 10012 (DMR76-02043 A02)

This is a continuation of work performed under DMR76-02043. Studies will be made of thermal expansion and the response to applied uniaxial stress of various A-15 crystals. Band model calculations for the A-15 crystals, based on a k.p approximation for bands near the corner of the Brillouin zone, will be made to attempt to account for the anomalous temperature dependence of the electrical resistivity of some A-15 crystals. These calculations will be extended to specific heat and certain elastic constants. The thermal expansion of single crystals of V3Si will be studied above and below Tc to test the predictions of the above model.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, GAUGE THEORIES AND HADRON PHYSICS

L. SUSSKIND, Yeshiva University, School of Science, *New York, New York* 10033 (PHY76-16992 A01)

Research will be done in a number of elementary particle dynamics and quantum field theory. These areas include: lattice gauge theory, hadron jets, and instantons. The purpose of the work is to explore both model and realistic field theories with the intent of better understanding the quark structure of hadrons and the behavior of hadronic processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0030, ELECTROMIGRATION IN METALS
H.B. HUNTINGTON, Rensselaer Polytechnic Inst., School of Science, *Troy, New York* 12181 (DMR77-24953)

Research previously supported by DMR76-81239.

The phenomenon of electromigration in metals will be studied. Of the projects to be pursued, two deal with interstitials, i.e., 'fast diffusers' in lead and other polyvalent metals, and gaseous impurities in the noble metals. Recently, improved accuracy and consistency in the measurements of nickel in lead have demonstrated a marked concentration dependence even in the range of a few parts per million. This work will be continued to study the behavior of cadmium in lead and of a series of fast diffusers in single crystal tin. The electromigration of hydrogen in copper will also be investigated. A third project will try to understand forced motion effects in Met-Glass systems, especially in the high-temperature range.

First year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, THEORETICAL ELEMENTARY PARTICLE PHYSICS
R.W. BROWN, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (PHY78-08883)

Of paramount importance in element particle theory is the question of the existence of the intermediate vector bosons, the carriers of the weak interaction force. Whether or not interactions other than quantum electrodynamics can be described via a field theory is at the heart of the new gauge theories. The success and self-consistency of these gauge theories in turn promises that weak bosons ought to exist and that they should have masses in the 30 to 100 GeV/c2 range, a range which can be explored with the next generation of high-energy accelerators.

The updating and extension of theoretical predictions for the production rates relevant to the very high energies of the future is thus quite important at this time and is the subject of the proposed research.

This work is a continuation of that currently supported under NSF grant PHY76-12245 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0032, PHYSICS QUARTZ PROCESSING
J.J. MARTIN, Okla. St. Univ., School of Arts & Sciences, *Stillwater, Oklahoma* 74075 (DF903320; F19628-77-C-0171)

The objective of this effort is to develop superior material for timing applications. How research contributes - development of new hardening techniques for quartz may result in superior quartz resonators. The Air Force function is navigation, communication, surveillance. Deficiency - presently available resonator materials suffer long-term frequency instability and radiation damage.

The approach will be a study of the defects produced by various types of radiation and develop methods to overcome defect formation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0033, MAGNETIC RESONANCE AND OPTICAL SPECTROSCOPY OF ANTIFERROMAGNETIC INSULATORS
W.A. SIBLEY, Okla. St. Univ., School of Arts & Sciences, *Stillwater, Oklahoma* 74075

The magnetic and optical properties of antiferromagnetic materials of type A3BCl6 and A3B2Cl9 will be examined in a multi-laboratory investigation. Crystals of the materials will be grown and studied by infrared absorption magnetic interactions and optical luminescence.

SUPPORTED BY North Atlantic Treaty Org.

8.0034, STUDIES IN NON-LINEAR CONTINUUM PHYSICS
R.S. RIVLIN, Lehigh University, Center for The Appl. of Math., *Bethlehem, Pennsylvania* 18015 (MCS77-20599)

Continuation of MCS-7406958.

Professor Rivlin will carry on his research program in nonlinear continuum physics with emphasis now on (1) wave propagation in nonlinear isotropic and anisotropic materials, (2) electrooptical and magnetooptical effects, and (3) non-Newtonian fluid mechanics.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

8.0035, STATISTICAL MECHANICS AND MATERIALS SCIENCE
J.F. NAGLE, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh, Pennsylvania* 15213 (DMR72-03203 A02)

This project is concerned with two main problem areas: (1) phase transitions in biomembranes, lipid bilayers and polymers; and (2) hydrogen bonded crystals, with an emphasis on the ferroelectric and antiferroelectric phase transitions in layered 'two-dimensional' crystals such as Cu (HCOO)2. 4H2O, NaH3(SeO3) and SnCl2.2H2O. The method of study involves theoretical modeling of the systems and performing statistical mechanical calculations, both approximate and exact. The object of these studies is to understand the physical and chemical mechanisms of the phase transitions and to calculate basic microscopic parameters from macroscopic measurements.

This is a continuation of research supported under DMR72-03203.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0036, VISCOSITY MEASUREMENT IN LIQUID CRYSTALS
S.V. LETCHER, Univ. of Rhode Island, School of Arts & Sciences, *Wakefield, Rhode Island* 02881 (DMR77-07813 A01)

Viscosity measurements of liquid crystalline phases, using for the most part a rectangular-capillary viscometer in a high magnetic field, are continued. For the nematic phase, previous viscosity measurements with different techniques have provided inconsistent results, probably due to defects in the nematic structure. The reasons for the discrepancies are being investigated. For the smectic and cholesteric phases, high magnetic fields--higher than those obtainable with standard electromagnets--are required to maintain molecule orientation during flow. Experiments using smaller fields or surface alignment can probe only narrow regimes of temperature and flow rate. The present high field experiments are uniquely able to probe the dynamic properties of these phases.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0037, LOCALIZED AND COLLECTIVE EXCITATION AND ORDERING PROCESSES IN IONIC CRYSTALS
F. LUTY, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (DMR77-12675 A01)

Research previously supported by DMR74-13870.

The investigations will cover a variety of systems with the purpose of establishing interconnections between localized defect and collective crystal behavior. (1) Molecular and off-center paraelectric defects will be investigated. Particular emphasis will be on studies of these systems under hydrostatic pressure. The close similarities of the pressure-induced transitions to the behavior of displacive ferroelectrics will be explored. (2) Mixed alkali-halide-cyanide crystals of the type KBr1-x(CN)x will be studied by means of Raman, optical and dielectric techniques. (3) Resonance Raman scattering and hot luminescence effects of F-center defects will be carried out. The systems to be studied will include hydrogen defects in alkali-halides. The motivation of this work, besides the fundamental interest in the interrelation of the resonance scattering process, will be the potential of these systems for broadly tunable IR laser application.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0038, POSITIVE AND NEGATIVE ION COLLISION STUDIES
R. GEBALLE, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (PHY78-00856)

Measurements will be made of partial cross sections for reactions X- plus hv yields X* plus e-, where X will be Li, Na and K, by optical detection of the excited states. The measurements will be made in two distinct regions of interest. Near the excitation threshold, an absolute normalization of the cross sections will be made. Far from threshold, predictions of correlation effects will be tested. A separate set of experiments will measure cross sections for low energy resonant charge exchange collisions between highly ionized species and various neutrals. The low-energy, highly ionized beam will be produced in a modified, laser-induced plasma. Absolute measurements of X-radiation from excited states of the product ion will be attempted in order to determine partial cross sections.

This is a continuation of work supported by NSF Grant PHY76-02055 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, THE IMPACT ON CONSUMERS OF REGULATORY REFORM IN RETAIL PRICING AND AIR TRANSPORTATION
L.E. SHEPARD, Univ. of California, Agric. Experiment Station, *Davis, California* 95616 (0070127; CA-D0-AEC-3408-HRD)

OBJECTIVE: Study the effects of repealing the fair trade laws on rural and other consumers. Assess the impact of airline deregulation on air fares and service to rural centers. Propose policy recommendations for future regulatory reform or retail pricing and air transportation.

APPROACH: Analyze pertinent legislation to deduce its rationale. Compare prices of fair traded goods in rural and urban areas before and after repeal of the law. Determine by surveys the impact of fair trade repeal on stores serving rural communities. Use regression analysis to compare fare and service differentials between rural and urban centers arising from airline deregulation.

PROGRESS: A sample of 200 fair trade items was constructed. From 4 to 8 retailers of various types (chain stores, independents, rural/urban, etc.) dealing in each product were identified and their prices for sample products were monitored. A computer program for analyzing data was constructed in order to assess the impact of repealing fair trade. A similar study, based on 100 outlets in the state, was designed to examine the effects of suspending retail milk prices in California. Econometric analysis was employed to test a model projecting the impact of deregulating air transportation as is contemplated by pending Congressional legislation. Particular attention was devoted to the impact on short feeder routes connecting small cities and rural centers. A preliminary draft of a summary journal article was prepared.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, California

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, INTERSTELLAR MOLECULAR LINE OBSERVATIONS AT 1 MM WAVELENGTH USING A JOSEPHSON MIXER
J. EDRICH, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210 (AST76-24241 A01)

A mixer receiver for the detection of millimeter wavelength signals will be completed. The receiver will be used for observations of interstellar molecular lines. The receiver is based on a Josephson mixer and followed by a low-noise maser with more than 100 MHz bandwidth. New permanent Josephson junctions and a closed-cycle refrigerator will be used in order to obtain reliable field operation. Field tests will be conducted at the 36-foot NRAO millimeter telescope at Kitt Peak.

This work is a continuation of research previously supported by NSF grant AST 76-24241.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, RESEARCH WITH A PHOTON-COUNTING IMAGE INTENSIFIER SPECTROMETER AT THE LAS CAMPANAS OBSERVATORY
L. SEARLE, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (AST76-20839 A01)

The 2.5 meter DuPont telescope at the Las Campanas Observatory has now gone into operation. It will be equipped with a large Cassegrain spectrograph, a television system for acquisition of faint objects, and a photon-counting image intensifier detector system. This system will be upgraded to the point where it may be used routinely for observational programs by all staff members.

The first program to be done is an investigation of the stellar content of star clusters in the Magellanic clouds in order to determine the distribution of the age and chemical composition of these subsystems and to assess their significance to the chemical and dynamical evolution of galaxies. The second program is a radial velocity survey of galaxies brighter than sixteenth magnitude in the Zwicky catalog in order to investigate the structure of galaxy clustering in velocity space and to map the extent of the perturbation of the velocity field around rich clusters of galaxies.

This is a continuation of work previously supported under NSF grant AST 76-20839.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, OBSERVATIONS OF MASS LOSS FROM HD-193793 AND OTHER WOLF-RAYET STARS
S.T. GOTTESMAN, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (AST78-01278)

Wolf-Rayet stars are hot, luminous stars with expanding atmospheres. Material is being ejected from them as a stellar wind at a rate of at least a billion times that of the sun. The structure, the physical cause for the high mass loss rates, and the evolutionary history of these stars are not understood. This project will be concerned with radio observations of Wolf-Rayet stars, and in particular one known as HD-193739. A large change has occurred in the stellar wind of HD 193793. By observing radio waves from the tenuous, outer regions of its stellar wind this disturbance can be studied. Variations in the rate of mass ejection, and the expansion velocity of the stellar wind will be determined.

In addition to HD 193793, only two other radio emitting Wolf-Rayet stars are known. The Very Large Array in New Mexico and the Green Bank radio interferometer in West Virginia will be used to search for radio emission from other Wolf-Rayet stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, RADIO STUDIES OF PHYSICAL PROCESSES IN AND THE MOLECULAR COMPOSITION OF INTERSTELLAR CLOUDS, CIRCUMSTELLAR SHELLS, AND COMETS
L.E. SNYDER, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST 77-01345 A01)

A three-part program of molecular research on astronomical sources will be carried out. The first part will be an observational study of silicon oxide maser sources to determine how far they have evolved, how intense they are, and whether there are new, nearby, undiscovered maser sources. The second part will be observational tests of specific molecular formation mechanisms in the interstellar clouds which, in turn, may enhance our understanding of interstellar abundance ratios and chemical fractionation. The third part will include radio observations of molecules in comets in order to advance our limited understanding of cometary chemistry. The ultimate goal of this research is to

understand the direction of galactic chemical evolution and its role in the various stages of star formation.

This action provides additional funding and extends the duration of the grant number AST 77-01345 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, ATMOSPHERES OF COOL STARS
R.K. HONEYCUTT, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (AST74-18929 A03)

The structure and chemical composition of the atmospheres of cool stars will be studied. In particular, attempts will be made to ascertain whether abundances can be reliably obtained by the spectrum synthesis technique using spectrophotometry at 2 angstroms resolution. Some variable stars will be monitored in order to determine whether a particular line strength variation observed between two stars is due to a change in abundance or a change in atmospheric structure. A program of vidicon coude spectroscopy will be initiated and will involve observations of an early M giant star and N-type carbon star. Construction of model atmospheres will be continued for giant, supergiant and dwarf stars. The detailed predictions of the model atmospheres will be compared with the observational data obtained and this will provide a means of testing the validity and accuracy of the theoretical models.

This research is a continuation of work previously supported by NSF grant AST 74-18929A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, STUDIES IN STELLAR EVOLUTION AND STAR FORMATION
B.P. FLANNERY, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (AST77-20370)

Several areas of theoretical research related to stellar evolution will be investigated. Model evolutionary sequences for high mass stars of low metallicity will be calculated. These stars are no longer present in our own galaxy but they have played an important role in the early history of nucleosynthesis in our galaxy, and they may be visible in other galaxies. The structure of cold interstellar clouds will be studied using a numerical technique similar to that employed in stellar evolution. This may provide some new information on star formation. There will also be an investigation of the role of radiative pumping on the fine structure excitation of atoms. This work can serve as an important diagnostic tool in the interpretation of the spectra of quasars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, THE STRUCTURE OF SYSTEMS OF GALAXIES
H.J. ROOD, Unknown Inst. or Indiv. Grant, *New Jersey* (AST77-17958)

Research on the structure of systems of galaxies contributes to our knowledge of cosmology and the evolution of galaxies. This proposal is concerned primarily with investigations into problems related to groups of galaxies and groups of galaxy clusters.

Twenty-one centimeter hydrogen line profiles of galaxies in groups obtained at the National Radio Astronomy Observatory will be used in an extensive virial analysis of nearby groups of galaxies to establish their characteristic mass-to-light ratio, the origin of various correlations among virial parameters, and whether the groups are mostly bound or expanding in the Hubble flow.

As an extension of a previously published study on groups of clusters, large samples of Abell clusters will be used to determine if groups of clusters are randomly distributed in space, if properties of clusters depend significantly on whether they are group members, and if the dominant motion of clusters in groups is the Hubble flow.

This is a continuation of work done under grant AST 75-18667.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, ASTRONOMICAL STUDIES RELATED TO LUNAR OCCULTATIONS
J.L. ELLIOT, Cornell University, Center for Radioph. & Sp. Res., *Ithaca, New York* 14850 (AST76-14832 A01)

Continuation of support is to complete analyses of the photometry, spectroscopic orbit and lunar occultation data for the Beta Scorpii system, also to determine constraints on the distance to Beta Scorpii, and to combine the results of all data on the Beta Scorpii system--spectroscopic orbit, Jupiter occultation, lunar occultation and photometry--to obtain the best estimates of the masses and luminosities of the stars in the system.

Further investigations of the rings of Uranus from occultation data will include a search for more, perhaps broad, rings of lower optical depth, a study of the variation of the ring optical depths at the three wavelengths of the observations, and a comparison of the optical depth profiles of the rings obtained for immersion and emersion from the Kuiper Airborne Observatory, and further comparison with the data obtained at Perth, Australia by the Lowell Observatory group. The results of this work should give further insight into the composition of the rings and help us to learn what physical processes determine their structure.

Prior support was by NSF grant AST 76-14832.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, STUDIES OF DEGENERATE STARS
H.M. VANHORN, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (AST76-80203 A01)

This work will be concerned with three main areas of research on degenerate stars: 1) There will be a study of the atmospheres and the internal structure and evolution of white dwarf stars. The non-radial oscillations and emission of gravitational radiation will be examined. 2) The properties of neutron stars will be studied. In particular there will be an investigation of the structure and evolution of cooling neutron stars and of neutron stars undergoing accretion. The non-radial oscillations and gravitational wave radiation of these objects will also be studied. 3) There will be a continuation of work on a computer program to permit the calculation of self-consistent, quasi-static models of the evolution of rotating stars. There will also be some research on magnetic field evolution in degenerate stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, INFRARED POLARIMETRY AT 1-10 MICRONS OF GALACTIC AND EXTRAGALACTIC OBJECTS
J.C. KEMP, Oregon State Higher Educ. Sys., School of Liberal Arts, *Eugene, Oregon* 97401 (AST76-24242 A01)

Observations of the polarization of infrared radiation emitted by quasistellar objects, BL-Lac objects, Seyfert galaxies, white dwarf stars with strong magnetic fields, and other related astronomical objects will be carried out. Spectrophotometry of the white dwarf stars will also be done. The interstellar polarization will be measured by observing bright stars. Observations of the linear and circular polarization will make it possible to decide if the radiation is emitted by the synchrotron process.

A double photoelastic polarimeter developed by Dr. Kemp at Oregon will be used with high-efficiency photometers designed by Dr. Rieke at Arizona. The observations will be made at Mt. Lemmon, Arizona, and will be at 1-5 and 9-13 microns to take advantage of the atmospheric windows. The system should be able to detect circular and linear polarizations as small as 0.01% but the practical limitation will be the flux from the source. It will be feasible to make precision observations of the polarization ranging from 0.05% to several percent.

This is a continuation of research done under grant AST 76-24242.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, ANALYSIS OF DIFFERENCES BETWEEN THE OBSERVED AND THEORETICAL POSITIONS OF MARS
R.L. DUNCOMBE, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: Transit Circle observations of Mars in the period 1968-1975 show departures in declination from the new ephemeris based on the theory of G.M. Clemence. The purpose of the investigation is to determine whether the discrepancy arises from a defect in the theory or an error in computing the ephemeris.

SUPPORTED BY University of Texas

10.0012, THE STRUCTURE AND CHEMICAL COMPOSITION OF GALACTIC AND EXTRAGALACTIC EMISSION NEBULAE

R.J. DUFOUR, Rice University, Graduate School, *Houston, Texas* 77001 (AST77-27214)

Optical studies of selected galactic and extragalactic emission nebulae will be carried out. The research encompasses both imagery and spectroscopy, as well as collaborative theoretical modeling where appropriate. The particular areas to be investigated include type I (helium- and nitrogen-rich) planetary nebulae in the Galaxy, galactic planetary nebulae with luminous central stars, ionized hydrogen regions located towards the galactic anticenter, supernova remnants in the Magellanic Clouds, and emission nebulae in the galaxies NGC 5128, NGC 5236, and NGC 6822. Most of the observations required to pursue these investigations have already been obtained at Cerro Tololo Inter-American Observatory and Kitt Peak National Observatory using modern sophisticated instrumentation. Consequently, the research consists primarily of data reduction and analysis. In this respect some of the most sophisticated computer hardware and software existing today for astronomical data analysis will be utilized. These include facilities at Rice University, the Johnson Space Center, and at Kitt Peak. The results of the proposed research will make important contributions to the knowledge about the chemical composition of Population I planetary nebulae, the shell ejection phase(s) of planetary nebulae, abundance gradients in the Galaxy, the structure and composition of supernova remnants in the Magellanic Clouds, and the chemical composition and possible abundance gradients in several other well-observed galaxies (NGC 5128, NGC 5236, and NGC 6822).

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0013, THE DYNAMICS OF GASEOUS NEBULAE

J.S. MATHIS, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (AST76-15384 A01)

The interaction of matter under the extreme conditions found in interstellar space is not well understood. The examination of the processes in diffuse nebulae will help us to understand the interaction and should provide the basic knowledge for interpretation of earth bound laboratory experiments.

An investigation of the dynamics of diffuse nebulae will be carried out to improve the understanding of the physics involved. A detailed integration of the internal structure of a variety of weak-D and strong-D ionization fronts, some of which contain internal shocks, will be made. Ionization fronts are classified as D or R, according to whether the neutral gas ahead of the front is more dense or more rare than the gas behind. Radiative transport, the effects of dust, and a careful treatment of the conditions in the neutral material will be included. For a given stellar flux and gas densities, these models will determine the spectrum emitted by, and the velocity of, the ionization front.

A second project will examine the overall motions within model nebulae with various given initial density distributions, using the results of the detailed integrations across the ionization fronts as boundary conditions. The most important improvements will be the inclusion of a variety of chemical elements in place of only hydrogen, and the inclusion of several frequencies, in an approximate way, into the radiation field. This is a continuation of research done under grant AST 76-15384.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, U.S. WOMEN FLIERS 1919-1928

K.L. BROOKS, Smithsonian Institution, *Washington, District of Columbia* 20560

This will be the second in a series of monographs on U.S. women fliers. It will be published in the Smithsonian Studies in Air and Space Series.

Research is presently underway. It will be submitted for publication in October 1978.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

VOLUME 16 NUMBER 20 / OCTOBER 23, 1978

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-29044*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN EXPERIMENTAL INVESTIGATION OF HINGELESS HELICOPTER ROTOR-BODY STABILITY IN HOVER

William G. Bousman Jun. 1978 49 p refs Prepared in cooperation with US Army Aviation Research and Development Command, St. Louis, Mo.

(NASA-TM-78489; AVRADCOM-TR-78-17(AM); A-7430) Avail: NTIS HC A03/MF A01 CSCL 02A

Model tests of a 1.62 m diameter rotor were performed to investigate the aeromechanical stability of coupled rotor-body systems in hover. Experimental measurements were made of modal frequencies and damping over a wide range of rotor speeds. Good data were obtained for the frequencies of the rotor lead-lag regressing mode. The quality of the damping measurements of the body modes was poor due to nonlinear damping in the gimbal ball bearings. Simulated vacuum testing was performed using substitute blades of tantalum that reduced the effective lock number to 0.2% of the model scale value while keeping the blade inertia constant. The experimental data were compared with theoretical predictions, and the correlation was in general very good. Author

N78-29045*# Gellman Research Associates, Inc., Jenkintown, Pa.

TECHNOLOGY TRANSFER AND OTHER PUBLIC POLICY IMPLICATIONS OF MULTI-NATIONAL ARRANGEMENTS FOR THE PRODUCTION OF COMMERCIAL AIRFRAMES

Final Report

Aaron J. Gellman and Jeffrey P. Price Jul. 1978 144 p refs (Contract NASw-2961)

(NASA-CR-159890) Avail: NTIS HC A07/MF A01 CSCL 02A

A study to examine the question of technology transfer through international arrangements for production of commercial transport aircraft is presented. The likelihood of such transfer under various representative conditions was determined and an understanding of the economic motivations for, effects of, joint venture arrangements was developed. Relevant public policy implications were also assessed. Multinational consortia with U.S. participation were focused upon because they generate the full range of pertinent public issues (including especially technology transfer), and also because of recognized trends toward such arrangements. An extensive search and analysis of existing literature to identify the key issues, and in-person interviews with executives of U.S. and European commercial airframe producers was reviewed. Distinctions were drawn among product-embodied, process, and management technologies in terms of their relative possibilities of transfer and the significance of such transfer. Also included are observations on related issues such as the implications of U.S. antitrust policy with respect to the formation of consortia and the competitive viability of the U.S. aircraft manufacturing industry. B.B.

N78-29046*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CTOL TRANSPORT TECHNOLOGY, 1978

1978 405 p refs Conf. held at Hampton, Va., 28 Feb. 3 Mar. 1978

(NASA-CP-2036-Pt-2; L-12178) Avail: NTIS HC A18/MF A01 CSCL 02A

Technology associated with advanced conventional takeoff and landing transport aircraft is discussed. Topics covered include: advanced aerodynamics and active controls; operations and safety; and advanced systems. Emphasis is placed on increased energy efficiency. For individual titles, see N78-29047 through N78-29064.

N78-29047*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ADVANCED AERODYNAMICS AND ACTIVE CONTROLS TECHNOLOGY

William J. Alford, Jr. *In its* CTOL Transport Technol., 1978 1978 p 523-531 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 02A

The results, status, and plans of NASA sponsored advanced aerodynamics and active controls technology activities are reported. Development of subsonic, energy efficient transport aircraft technologies is emphasized. J.M.S.

N78-29048*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL RESULTS OF WINGLETS ON FIRST, SECOND, AND THIRD GENERATION JET TRANSPORTS **c05**

Stuart G. Flechner and Peter F. Jacobs *In its* CTOL Transport Technol., 1978 1978 p 553-569 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

Results of wind tunnel investigations of four jet transport configurations representing both narrow and wide-body configurations and also a future advanced aerodynamic configuration are presented including performance and wing root bending moment data. The effects of winglets on the aerodynamic characteristics throughout the flight envelope were studied. The results indicate that winglets improved the cruise lift to drag ratio between 4 and 8 percent, depending on the transport configuration. The data also indicate that ratios of relative aerodynamic gain to relative structural weight penalty for winglets are 1.5 to 2.5 times those for wing-tip extensions. Over the complete range of flight conditions, winglets produce no adverse effects on buffet onset, lateral-directional stability, and aileron control effectiveness. J.M.S.

N78-29049*# Douglas Aircraft Co., Inc., Long Beach, Calif.

WINGLET AND LONG DUCT NACELLE AERODYNAMIC DEVELOPMENT FOR DC-10 DERIVATIVES **c02**

A. Brian Taylor *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 609-623 refs (For primary document see N78-29046 20-01)

(Contract NAS1-14743)

Avail: NTIS HC A18/MF A01 CSCL 01A

Advanced technology for application to the Douglas DC-10 transport is discussed. Results of wind tunnel tests indicate that the winglet offers substantial cruise drag reduction with less wing root bending moment penalty than a wing-tip extension of the same effectiveness and that the long duct nacelle offers substantial drag reduction potential as a result of aerodynamic and propulsion improvements. The aerodynamic design and test of the nacelle and pylon installation are described. J.M.S.

N78-29050*# Boeing Commercial Airplane Co., Seattle, Wash.
APPLICATION OF WINGLETS AND/OR WING TIP EXTENSIONS WITH ACTIVE LOAD CONTROL ON THE BOEING 747 **c05**

Robert L. Allison, Brian R. Perkin, and Richard L. Schoenman *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 625-646 refs (For primary document see N78-29046 20-01)

(Contract NAS1-14741)

Avail: NTIS HC A18/MF A01 CSCL 01C

The application of wing tip modifications and active control technology to the Boeing 747 airplane for the purpose of improving fuel efficiency is considered. Wing tip extensions, wing tip winglets, and the use of the outboard ailerons for active wing load alleviation are described. Modest performance improvements are indicated. A costs versus benefits approach is taken to decide which, if any, of the concepts warrant further development and flight test leading to possible incorporation into production airplanes.J.M.S.

N78-29051*# Lockheed-California Co., San Diego.
DEVELOPMENT AND FLIGHT EVALUATION OF ACTIVE CONTROLS IN THE L-1011 **c05**

J. F. Johnston and D. M. Urie *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 647-685 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

Active controls in the Lockheed L-1011 for increased energy efficiency are discussed. Active wing load alleviation for extended span, increased aspect ratio, and active stability augmentation with a smaller tail for reduced drag and weight are among the topics considered. Flight tests of active wing load alleviation on the baseline aircraft and moving-base piloted simulation developing criteria for stability augmentation are described. J.M.S.

N78-29052*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED AERODYNAMICS AND ACTIVE CONTROLS FOR A NEXT GENERATION TRANSPORT **c02**

A. Brian Taylor *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 687-708 refs (For primary document see N78-29046 20-01)

(Contract NAS1-14744)

Avail: NTIS HC A18/MF A01 CSCL 01A

In aerodynamics, the use of new and flexible tools for the design of supercritical wings is discussed. Trends in the design and performance of highlift devices are outlined. In the field of active controls, the determination of suitable configurations with regard to flying qualities is described, particularly related to results from a piloted simulation. J.M.S.

N78-29053*# Boeing Commercial Airplane Co., Seattle, Wash.
ACTIVE CONTROLS TECHNOLOGY TO MAXIMIZE STRUCTURAL EFFICIENCY **c08**

James M. Hoy and James M. Arnold (Boeing Co., Wichita, Kans.) *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 709-732 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

The implication of the dependence on active controls technology during the design phase of transport structures is considered. Critical loading conditions are discussed along with probable ways of alleviating these loads. Why fatigue requirements may be critical and can only be partially alleviated is explained. The significance of certain flutter suppression system criteria is examined. J.M.S.

N78-29054*# National Aeronautics and Space Administration, Washington, D. C.
OVERVIEW OF SAFETY RESEARCH **c03**

John H. Enders *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 735-756 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

Aircraft safety is reviewed by first establishing a perspective of air transportation accidents as a function of calendar year, geographic area, and phase of flight, and then by describing the threats to safety and NASA research underway in the three representative areas of engine operational problems, meteorological phenomena, and fire. Engine rotor burst protection, aircraft nacelle fire extinguishment, the aircraft-weather interface, severe weather wind shears and turbulence, clear air turbulence, and lightning are among the topics covered. Fire impact management through fire resistant materials technology development is emphasized. J.M.S.

N78-29055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WAKE VORTEX TECHNOLOGY **c02**

R. Earl Dunham, Jr., Marvin R. Barber (NASA. Dryden Flight Res. Center), and Delwin R. Croom *In its* CTOL Transport Technol., 1978 1978 p 757-771 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01A

A brief overview of the highlights of NASA's wake vortex minimization program is presented. The significant results of this program are summarized as follows: (1) it is technically feasible to reduce significantly the rolling upset created on a trailing aircraft; (2) the basic principles or methods by which reduction in the vortex strength can be achieved have been identified; and (3) an analytical capability for investigating aircraft vortex wakes has been developed. J.M.S.

N78-29056*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF NASA LANDING-GEAR RESEARCH **c05**

Bruce D. Fisher, Robert K. Sleeper, and Sandy M. Stubbs *In its* CTOL Transport Technol., 1978 1978 p 773-804 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

Research relative to tire tread, powered-wheel taxiing, air cushion landing systems, and crosswind landing gear is discussed. J.M.S.

N78-29057*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE PREDICTION TECHNOLOGY FOR CTOL AIRCRAFT **c71**

John P. Raney *In its* CTOL Transport Technol., 1978 1978 p 805-818 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 20A

The application of a new aircraft noise prediction program to CTOL noise prediction is outlined. Noise prediction is based on semiempirical methods for each of the propulsive system noise sources, such as the fan, the combustor, the turbine, and jet mixing, with noise-critical parameter values derived from the thermodynamic cycle of the engine. Comparisons of measured and predicted noise levels for existing CTOL aircraft indicate an acceptable level of accuracy. J.M.S.

N78-29058*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT EXPERIMENTS TO IMPROVE TERMINAL AREA OPERATIONS **c05**

Seymour Salmirs and Samuel A. Morello *In its* CTOL Transport Technol., 1978 1978 p 819-847 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

A brief description is given of the objectives and activities of the terminal configured vehicle (TCV) program and of some of the airborne facilities. A short analysis of some particular problems in CTOL operations in the terminal area is also presented to show how the program's technical objectives are related to the defined problems. The test aircraft was flown both manually and automatically with manual monitoring over paths including 130 deg intercepts and 2.0 km and 0.8 km finals. Some statistical data are presented from these and other flight profiles designed to address specific terminal area problems. An overview is

presented of research studies receiving emphasis in the next biennium and their application to the terminal area. A description of work undertaken to study the addition of adjacent traffic information to present map displays is also given. J.M.S.

N78-29059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATING AIRLINE OPERATING COSTS c82
Dal V. Maddalon *In its* CTOL Transport Technol., 1978 1978 p 849-870 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 05C

The factors affecting commercial aircraft operating and delay costs were used to develop an airline operating cost model which includes a method for estimating the labor and material costs of individual airframe maintenance systems. The model permits estimates of aircraft related costs, i.e., aircraft service, landing fees, flight attendants, and control fees. A method for estimating the costs of certain types of airline delay is also described. J.M.S.

N78-29060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD FOR THE ANALYSIS OF THE BENEFITS AND COSTS FOR AERONAUTICAL RESEARCH AND TECHNOLOGY c85
Louis J. Williams, Herbert H. Hoy, and Joseph L. Anderson *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 871-884 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 05A

A relatively simple, consistent, and reasonable methodology for performing cost-benefit analyses which can be used to guide, justify, and explain investments in aeronautical research and technology is presented. The elements of this methodology (labeled ABC-ART for the Analysis of the Benefits and Costs of Aeronautical Research and Technology) include estimation of aircraft markets; manufacturer costs and return on investment versus aircraft price; airline costs and return on investment versus aircraft price and passenger yield; and potential system benefits--fuel savings, cost savings, and noise reduction. The application of this methodology is explained using the introduction of an advanced turboprop powered transport aircraft in the medium range market in 1978 as an example. J.M.S.

N78-29061*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHORT-HAUL CTOL AIRCRAFT RESEARCH c05
Louis J. Williams *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 891-908 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The results of the reduced energy for commercial air transportation studies on air transportation energy efficiency improvement alternatives are reviewed along with subsequent design studies of advanced turboprop powered transport aircraft. The application of this research to short-haul transportation is discussed. The results of several recent turboprop aircraft design are included. The potential fuel savings and cost savings for advanced turboprop aircraft appear substantial, particularly at shorter ranges. J.M.S.

N78-29062*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS IN SUPERSONIC CRUISE AIRCRAFT TECHNOLOGY c05
Cornelius Driver *In its* CTOL Transport Technol., 1978 1978 p 909-925 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The supersonic cruise aircraft research program identified significant improvements in the technology areas of propulsion, aerodynamics, structures, takeoff and landing procedures, and advanced configuration concepts. Application of these technology areas to a commercial aircraft is discussed. An advanced SST family of aircraft which may be environmentally acceptable, have flexible range-payload capability, and be economically viable is projected. J.M.S.

N78-29063*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS ON COAL-DERIVED FUELS FOR AVIATION SYSTEMS c28
Robert D. Witcofski *In its* CTOL Transport Technol., 1978 1978 p 927-950 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 21D

The results of engineering studies of coal-derived aviation fuels and their potential application to the air transportation system are presented. Synthetic aviation kerosene (SYN. JET-A), liquid methane (LCH4) and liquid hydrogen (LH2) appear to be the most promising coal-derived fuels. Aircraft configurations fueled with LH2, their fuel systems, and their ground requirements at the airport are identified. Energy efficiency, transportation hazards, and costs are among the factors considered. It is indicated that LCH4 is the most energy efficient to produce, and provides the most efficient utilization of coal resources and the least expensive ticket as well. J.M.S.

N78-29064*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDIES OF ADVANCED TRANSPORT AIRCRAFT c05
A. L. Nagel *In its* CTOL Transport Technol., 1978 1978 p 951-982 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

Several concepts for possible future airplanes, including all-wing distributed-load airplanes, multibody airplanes, a long-range laminar flow control airplane, a nuclear-powered airplane designed for towing conventionally powered airplanes during long-range cruise, and an aerial transportation system comprised of continuously flying liner airplanes operated in conjunction with short-range feeder airplanes are described. Performance and economic advantages of each concept are indicated. Further research is recommended in the following areas: all-wing airplane aerodynamics, aerial rendezvous, nuclear aircraft engines, air-cushion landing systems, and laminar flow control, as well as the basic research discipline areas of aerodynamics, structures, propulsion, avionics, and computer applications. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-29065 Oklahoma State Univ., Stillwater.
FLOW INSTABILITY AND ACOUSTIC RADIATION MEASUREMENTS OF LOW REYNOLDS NUMBER SUPERSONIC JETS Ph.D. Thesis
Gerald Lee Morrison 1977 212 p
Avail: Univ. Microfilms Order No. 7811060

Flow field and acoustic measurements were made in low Reynolds number Mach 1.4, 2.1, and 2.5 jets. The Mach number 2.1 and 2.5 jets both contain a band of unstable frequencies, while the Mach number 1.4 jet contains a much narrower spectral range. It was apparent that the jet instability was comprised of more unstable spectral components as the Mach number increased. It was observed that for all three Mach numbers, the mode of the instability was initially the $n = +1$ and $n = -1$ modes occurring simultaneously (resulting in the jet flapping up and down). In the Mach number 2.1 and 2.5 jets, it was observed that the mode transformed into a helix ($n = -1$) shortly past the end of the potential core. The transformation to a helix was accompanied by a substantial decrease in the coherence of the flow fluctuations. The instability in the Mach number 1.4 jet lost its coherence before such a transformation could be observed. Dissert. Abstr.

N78-29066# British Library Lending Div., Boston Spa (England).
INVESTIGATING AERODYNAMIC TRANSVERSE FORCES IN LABYRINTH SEALS IN CASES INVOLVING ROTOR ECCENTRICITY
S. S. Rosenberg et al 16 Dec. 1977 12 p refs Transl. into

ENGLISH from Energomashinostroenie (USSR), v. 8, no. 8, 1974 p 15-17
(BLL-CE-Trans-7083-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Zones of different pressures lying on different sides of a plane passing through the rotor and the stator axes of gas turbines result in transverse forces which are perpendicular to the plane and tend to place the shaft center line in the direction of rotation. Such spiral effect causes direct precession of the rotor. An air turbine was used to investigate the magnitude of preliminary twisting of the flow in the shrouding seals, and the circumferential differential distribution of pressures in the seal in cases where eccentricity exists. Measurements reveal a considerable circumferential nonuniformity of pressure and a 75-78 deg deviation from the axial direction. A.R.H.

N78-29067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

WIND TUNNEL INVESTIGATION OF COMPUTATIONALLY OPTIMIZED VARIABLE CAMBER WING CONFIGURATIONS

E. G. Waggoner (Vought Corp., Dallas), H. P. Haney (Vought Corp., Dallas), and W. F. Ballhaus Jun. 1978 140 p refs Prepared in part by AVRADCOM
(NASA-TM-78479; AVRADCOM-TR-78-32(AM); A-7394) Avail: NTIS HC A07/MF A01 CSCL 01A

An experimental investigation was performed in the NASA Ames Research Center 14 foot transonic wind tunnel to determine aerodynamic characteristics for several optimized configurations of a variable camber wing model. Camber and twist distributions which were computationally defined using both subsonic and transonic potential flow analysis codes linked to an optimization technique were verified. The 35 deg swept wing was characterized by multisegmented leading and trailing edge flaps whose hinge lines are swept relative to the leading and trailing edges of the wing. The deflection angles of the flap segments could be varied, therefore affording the possibility of optimizing the camber and twist distribution for a given design condition. The test configurations were designed using potential flow analysis codes linked to a constrained minimization technique. Camber and twist distributions were optimized at lift coefficients of 0.2, 0.4, and 0.6 for Mach numbers of 0.6 and 0.9. B.B.

N78-29068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CLOSED-FORM EQUATIONS FOR THE LIFT, DRAG, AND PITCHING-MOMENT COEFFICIENTS OF AIRFOIL SECTIONS IN SUBSONIC FLOW

Roger L. Smith Aug. 1978 58 p refs Prepared in cooperation with the US Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TM-78492; AVRADCOM-TR-78-15(AM); A-7464) Avail: NTIS HC A04/MF A01 CSCL 01A

Closed-form equations for the lift, drag, and pitching moment coefficients of two dimensional airfoil sections in steady subsonic flow were obtained from published theoretical and experimental results. A turbulent boundary layer was assumed to exist on the airfoil surfaces. The effects of section angle of attack, Mach number, Reynolds number, and the specific airfoil type were considered. The equations were applicable through an angle of attack range of -180 deg to +180 deg; however, above about + or - 20 deg, the section characteristics were assumed to be functions only of angle of attack. A computer program is presented which evaluates the equations for a range of Mach numbers and angles of attack. Calculated results for the NACA 23012 airfoil section were compared with experimental data. J.A.M.

N78-29069# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

A STUDY OF THE LIFT-TO-DRAG RATIO CAPABILITY OF CARET WING WAVERIDERS M.S. Thesis Interim Scientific Report

Marshall D. Solomon Mar. 1978 217 p refs
(Contract F44620-76-C-0049)
(AD-A053691; TR-200; AFOSR-78-0758TR) Avail: NTIS HC A10/MF A01 20/4

A simple model of the off design caret wing flow field which includes the effects of an upper expansion surface, skin friction and base drag is proposed. Based on this approximate model, calculations of the lift coefficient, drag coefficient and lift-to-drag ratio as functions of body geometry, incidence, Mach number and Reynolds number are made and the dependence of the aerodynamic coefficients on these variables is identified. A test matrix covering a wide range of caret wings and flight conditions is employed in a search for wings with high lift-to-drag ratio. Caret wing performance is then compared to that of delta wing. Lift-to-drag ratios as high as 6.5 for 5 percent thick wings at free stream Mach number and Reynolds number of 2.0 and 10,000,000 were found. This performance is similar to that of delta wings. However, significantly higher caret wing lift-to-drag ratios could be achieved by replacing the blunt base with an afterbody, thereby reducing the base drag. Author (GRA)

N78-29070# Nielsen Engineering and Research, Inc., Mountain View, Calif.

A PRELIMINARY METHOD FOR CALCULATING THE AERODYNAMIC CHARACTERISTICS OF CRUCIFORM MISSILES TO HIGH ANGLES OF ATTACK INCLUDING EFFECTS OF ROLL ANGLE AND CONTROL DEFLECTIONS Annual Report, 1 Oct. 1976 - 30 Sep. 1977

Jack N. Nielsen, Michael J. Hemsch, and Charles A. Smith 1 Nov. 1977 336 p refs
(Contract N00014-74-C-0050)
(AD-A054349; NEAR-TR-152; ONR-CR215-226-4F) Avail: NTIS HC A15/MF A01 CSCL 20/4

A method is presented together with a computer program for calculating the forces and moments on the components of a cruciform missile: nose, canard section, afterbody, and tail section. The program utilizes a skeleton data base for the fin normal forces and center-of-pressure positions. These quantities were derived from a set of fins of varying aspect ratio and taper ratio tested on a body having a diameter equal to half the tail span. The data base, covering a range 0.8 < or = M at infinity < or = 3.0, is extended to arbitrary cruciform body-tail configurations or body-wing-tail configurations using analytical and empirical methods. Pitch, yaw, and roll control are included in the method as well as the effects of missile roll angle. Comparisons are made between the predictions of the computer program and experiment for fin forces and configuration forces and moments for body-tail and wing-body-tail combinations up to angles of attack of 45 deg. On the whole acceptable agreement between prediction and experiment is obtained. Author (GRA)

N78-29071# Flow Research, Inc., Kent, Wash.

NUMERICAL SOLUTIONS OF THE UNSTEADY TRANSONIC SMALL-DISTURBANCE EQUATIONS Final Report

M. M. Hafez, M. H. Rizk, E. M. Murman, and L. C. Wellford Oct. 1977 68 p refs
(Contract F33615-76-C-3067; AF Proj. 2307)
(AD-A054036; FLOW-RR-83; AFFDL-TR-77-100) Avail: NTIS HC A04/MF A01 CSCL 20/4

Three problems pertinent to the numerical solution of the unsteady transonic small-disturbance equation are studied. The first problem is the numerical instabilities arising in the solution of the harmonic perturbation potential equation. Several remedies that have been tested are suggested. The second problem is the movement of unsteady shock waves in the harmonic perturbation approach. A formulation and computed example are presented. The third problem is a finite-element formulation for unsteady transonic flow. Preliminary calculations are given.
Author (GRA)

N78-29072# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Theoretische Aerodynamik.

CALCULATION OF PRESSURE DISTRIBUTION, FORCES AND MOMENTS FOR THE FIGHTER CONFIGURATION IAe 60 BY PANEL METHOD

V. G. Torregiani and S. R. Ahmed Oct. 1977 29 p refs
(DLR-IB-151-77/13) Avail: NTIS HC A03/MF A01

Preliminary results of inviscid calculations of the pressure distribution, forces and moments for the fighter plane configuration IAE 60 are presented. The symmetrical case without yaw is considered for the incompressible flow regime and calculations were performed for two angles of attack. Experimental results are available only for total lift and pitching moment - qualitative

agreement was obtained between these and the theoretical results. The results were obtained using the panel method developed by DFVLR. ESA

N78-29073# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
INVESTIGATION OF THE UNSTEADY AIRLOADS ON WING-STORE CONFIGURATIONS IN SUBSONIC FLOW
J. W. G. vanNunen, R. Roos, and J. J. Meijer 12 Sep. 1977 12 p refs Presented at the AGARD Fluid Dyn. Panel. Symp. on Unsteady Aerodyn., Ottawa, 26-28 Sep. 1977, and at the 4th JTCG Aircraft/Stores Compatibility Symp., Ft. Walton Beach, Fla., 12-14 Oct. 1977 Sponsored by Air Mater. Directorate (RNLAF)
(NLR-MP-77025-U) Avail: NTIS HC A02/MF A01

A description and results are given of an extensive research program set up to determine the unsteady aerodynamic loading on oscillating wing-store configurations. It is shown that the tools developed in the course of the program allow for a more accurate prediction of the unsteady air forces introduced by wing mounted stores. Author (ESA)

N78-29074# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
INVESTIGATIONS OF THE TRANSONIC FLOW AROUND OSCILLATING AIRFOILS Ph.D. Thesis - Tech. Hogeschool Delft, Neth.
H. Tijdeman 21 Oct. 1977 136 p refs
(NLR-TR-77090-U) Avail: NTIS HC A07/MF A01

Exploratory wind tunnel experiments in high-subsonic and transonic flow on a conventional airfoil with oscillating flap and a supercritical airfoil oscillating in pitch are described. In the analysis of the experimental results, emphasis is placed upon the typical aspects of transonic flow, namely, the interaction between the steady and unsteady flow fields, the periodical motion of the shock waves, and their contribution to the overall unsteady airloads. Special attention is paid to the behavior of the supercritical airfoil in its shock-free design condition. Moreover, it is discussed to what extent linearization of the unsteady transonic flow problem is allowed if the unsteady field is considered as a small perturbation superimposed upon a given mean steady-flow field. Finally, the current status of unsteady transonic flow theory is reviewed and the present test data are used to evaluate some of the recently developed calculation methods. Author (ESA)

N78-29075# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Entwurfsaerodynamik.
CALCULATION OF THE INTERFERENCE BETWEEN CIVIL-MILITARY TRANSPORT AIRCRAFT ENGINE AND BASIS WING ACCORDING TO THE VORTEX CONDUCTOR PROCEDURE [BERECHNUNG DER INTERFERENZWIRKUNG ZWISCHEN TRIEBWERKS- UND BASISFLUEGEL AM ZIVIL-MILITAERISCHEN TRANSPORTER NACH DEM WIRBELLEITERVERFAHREN]
W. Schroeder Dec. 1977 98 p ref In GERMAN Prepared jointly with VFW-Fokker GmbH, Bremen Report will also be announced as translation (ESA-TT-493)
(DLR-IB-151-77/19) Avail: NTIS HC A05/MF A01

For incompressible symmetric flow calculations of the interference between engine and basis wing of the VFW-Fokker 614 civil-military transport aircraft model were performed. The following parameters were used: angle of attack 0, 3, and 5 deg for three different engine wings each with -10 %, 10 %, 30% or 50% overlap between engine and basis wing. The results of the linear and nonlinear calculations are discussed. ESA

N78-29049*# Douglas Aircraft Co., Inc., Long Beach, Calif.
WINGLET AND LONG DUCT NACELLE AERODYNAMIC DEVELOPMENT FOR DC-10 DERIVATIVES
A. Brian Taylor *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 609-623 refs (For primary document see N78-29046 20-01)
(Contract NAS1-14743)
Avail: NTIS HC A18/MF A01 CSCL 01A

N78-29052*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED AERODYNAMICS AND ACTIVE CONTROLS FOR A NEXT GENERATION TRANSPORT
A. Brian Taylor *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 687-708 refs (For primary document see N78-29046 20-01)
(Contract NAS1-14744)
Avail: NTIS HC A18/MF A01 CSCL 01A

N78-29055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WAKE VORTEX TECHNOLOGY
R. Earl Dunham, Jr., Marvin R. Barber (NASA. Dryden Flight Res. Center), and Delwin R. Croom *In its* CTOL Transport Technol., 1978 1978 p 757-771 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-29076*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
DEMAND MODELLING OF PASSENGER AIR TRAVEL: AN ANALYSIS AND EXTENSION. VOLUME 1: BACKGROUND AND SUMMARY Final Report
I. D. Jacobson Aug. 1978 36 p refs
(Grant NsG-7266)
(NASA-CR-157469; UVA/528148/MAE78/101-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 05C

The framework for a model of travel demand which will be useful in predicting the total market for air travel between two cities is discussed. Variables to be used in determining the need for air transportation where none currently exists and the effect of changes in system characteristics on attracting latent demand are identified. Existing models are examined in order to provide insight into their strong points and shortcomings. Much of the existing behavioral research in travel demand is incorporated to allow the inclusion of non-economic factors, such as convenience. The model developed is characterized as a market segmentation model. This is a consequence of the strengths of disaggregation and its natural evolution to a usable aggregate formulation. The need for this approach both pedagogically and mathematically is discussed. A.R.H.

N78-29077# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
POWERED INERTIA REEL RETRACTION DURING EJECTION Final Report, 1 Jun. 1977 - 30 Nov. 1977
Kenneth Miller, Alan Cantor, and William Ward 20 Apr. 1978 34 p
(AD-A054157; NADC-78055-60) Avail: NTIS HC A03/MF A01 CSCL 06/7

The purpose of this program was to determine the potential effectiveness of upper torso restraint afforded by PIR (Powered Inertia Reel) actuation at inception of the ejection stroke. This program was jointly funded by the Navy and Air Force, and the results are applicable to the Navy A-7 and the Air Force A-10 aircraft escape systems. Twelve tests were conducted on the NADC Ejection Tower to compare dummy responses for six sets of tests with initial conditions of PIR retraction being varied in each set (one test with retraction, one without). A number of the tests were duplicated in order to demonstrate repeatibility of results. It was demonstrated that the tested PIR is not effective in overcoming ejection loads imposed on the dummy during the onset phase of the catapult stroke. Author (GRA)

N78-29054*# National Aeronautics and Space Administration, Washington, D. C.
OVERVIEW OF SAFETY RESEARCH
John H. Enders *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 735-756 refs (For primary document

see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-29078# Civil Aeromedical Inst., Oklahoma City, Okla.
COMPARATIVE READABILITY OF ENROUTE LOW ALTITUDE CHARTS
Paul G. Rasmussen, Kenneth W. Welsh, and John A. Vaughan Apr. 1978 15 p ref
(AD-A054796; FAA-AM-78-17) Avail: NTIS HC A02/MF A01 CSCL 08/2

Eleven male and seven female nonpilot subjects with 20/20 near visual acuity were used to determine possible derogatory effects on chart usability as the result of terrain depiction on en route low altitude charts. Results indicate that shaded terrain depiction reduces readability of alphanumeric data as measured by increases in reading errors and reading time. Losses are attributed to the low figure-to-ground contrast ratios between the chart legends and the terrain background. Losses are most pronounced for alphanumeric data printed in small character sizes and with light inking densities. Losses are also evident for some large character sizes and heavy inking densities where mountainous terrain is depicted by heavy inking densities. Losses are particularly evident under low luminance levels but also occur to a lesser extent at elevated luminance levels. Differences between the experimental and standard versions of the charts are least pronounced when the terrain depiction introduced only a moderate reduction in figure-to-ground contrast level and the items were viewed at elevated luminance levels. A.R.H.

N78-29079# Transportation Systems Center, Cambridge, Mass.
BIBLIOGRAPHY AND COMMENTS ON LORAN-C GROUND WAVE PROPAGATION Final Report, 1941 - 1977
Carol Veronda Dec. 1977 54 p refs
(PB-279463/4; DOT-TSC-RSPD-77-2) Avail: NTIS HC A04/MF A01 CSCL 17G

A selected bibliography is presented of work dealing with ground wave propagation of Loran-C signals. The selected works include reports of both theoretical and measurement activities over both water and land. A summary of and comments on Loran-C time difference errors to be expected as a result of only ground wave propagation effects are given with references to the original work. Estimates of probable propagation errors for a few typical paths are made from previously published data and are presented. GRA

N78-29080# General Accounting Office, Washington, D. C. Logistics and Communications Div.
NAVIGATION PLANNING--NEED FOR A NEW DIRECTION
21 Mar. 1978 115 p
(PB-278627/5; LCD-77-109) Avail: NTIS HC A06/MF A01 CSCL 17G

Improved planning and management of the Department of Defense's navigation satellite system, NAVSTAR, is suggested in order to realize its benefits as a national resource. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-29081 Georgia Inst. of Tech., Atlanta.
A STOCHASTIC MODEL FOR FATIGUE AND OPTIMUM DESIGN AND MAINTENANCE METHODOLOGIES Ph.D. Thesis
Bapa Rao Uppaluri 1978 233 p
Avail: Univ. Microfilms Order No. 7810820

A methodology was developed for cost effective fatigue design of structures subject to random fatigue loading. A stochastic model for fatigue crack propagation under random loading was discussed. Fracture mechanics was used to estimate the parameters of the model and the residual strength of structures with cracks. The stochastic model and residual strength variations were used to develop procedures for estimating the probability of failure and its changes with inspection frequency. This information on reliability was used to construct an objective function, in terms of either a total weight function or cost function. A procedure for selecting the design variables, subject to constraints, by optimizing the objective function was illustrated by examples. In particular, optimum fail-safe design of stiffened panel was discussed. Dissert. Abstr.

N78-29082*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS TO REDUCE CIVIL HELICOPTER LIFE CYCLE COST
Stephen J. Blewitt Aug. 1978 58 p refs
(Contract NAS1-13624)
(NASA-CR-145379) Avail: NTIS HC A04/MF A01 CSCL 01C

The problem of the high cost of helicopter development, production, operation, and maintenance is defined and the cost drivers are identified. Helicopter life cycle costs would decrease by about 17 percent if currently available technology were applied. With advanced technology, a reduction of about 30 percent in helicopter life cycle costs is projected. Technological and managerial deficiencies which contribute to high costs are examined, basic research and development projects which can reduce costs include methods for reduced fuel consumption; improved turbine engines; airframe and engine production methods; safety; rotor systems; and advanced transmission systems. A.R.H.

N78-29083*# Boeing Vertol Co., Philadelphia, Pa.
CIVIL HELICOPTER DESIGN AND OPERATIONAL REQUIREMENT
Kenneth T. Waters Aug. 1978 52 p refs
(Contract NAS1-13624)
(NASA-CR-145377; D210-11278-1) Avail: NTIS HC A04/MF A01 CSCL 01C

Design and operational requirements and other factors that have a restraining influence on expansion of the helicopter market are discussed. The needs of operators, users, pilots and the community at large are examined. The impact of future technology developments and other trends such as use, energy shortages, and civil and military helicopter requirements and development is assessed. Areas where research and development are needed to provide opportunities for lowering life cycle costs and removing barriers to further expansion of the industry are analyzed. A.R.H.

N78-29084# Lockheed-California Co., Burbank.
GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS USER'S MANUAL VOLUME 2: INPUT-OUTPUT, TECHNIQUES AND APPLICATIONS Final Report
Max A. Gamon, Gil Wittlin, and William L. LaBarge Feb. 1978 183 p refs
(Contract DOT-FA75WA-3707)
(AD-A054317; LR-28307-Vol-2; FAA-RD-77-189,2-Vol-2)
Avail: NTIS HC A09/MF A01 CSCL 01/2

A comprehensive description of program KRASH is provided. Included in this volume of the user's manual are the following sections: (1) user's guide; (2) math model development (3) KRASH data requirements; and (4) typical model arrangements. This volume was established in such a manner that it can readily be updated as more data becomes available. The subject matter contained within each section can be expanded or revised, as necessary, without affecting the other sections. Each section

contains its own numbering system which facilitates the task of updating the document. G.Y.

N78-29085# Lockheed-California Co., Burbank.
GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS USER'S MANUAL VOLUME 3: RELATED DESIGN INFORMATION Final Report, Jun. 1976 - Feb. 1978
Feb. 1978 121 p refs
(Contract DOT-FA75WA-3707)
(AD-A054266; LR-28307-Vol-3; FAA-RD-77-189,3-Vol-3)
Avail: NTIS HC A06/MF A01 CSCL 01/2

General information is presented in this report to assist the general aviation airplane industry designer in developing improved structural crashworthiness designs. This report is initiated for the purpose of providing the General Aviation Manufacturers Association (GAMA) members with the basis for understanding the types of procedures, methods and data that are available with regard to structural crashworthiness. The information presented in this volume is intended to compliment the KRASH User's Manual (Volume 1) as well as other analytical or test methods that are applicable to structural crashworthiness design. G.Y.

N78-29086*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
A THEORETICAL INVESTIGATION OF GROUND EFFECTS ON USB CONFIGURATIONS Final Report
C. Edward Lan Aug. 1978 130 p
(Contract NsG-1139)
(NASA-CR-157355; CRINC-FRL-281-3) Avail: NTIS HC A07/MF A01 CSCL 01C

A theoretical wing-jet interaction theory is presented for predicting the ground effects for upper surface blowing configurations. The formulation predicts the variation of circulation forces and jet reaction forces in ground proximity as a function of ground height. The predicted results agree well with available experimental data. It is shown that the wing-alone theory is not capable of predicting the ground effect for USB configurations. Author

N78-29087# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DIGITAL SIMULATION OF FLEXIBLE AIRCRAFT RESPONSE TO SYMMETRICAL AND ASYMMETRICAL RUNWAY ROUGHNESS Final Report, Sep. 1975 - Aug. 1976
Anthony G. Gerardi Aug. 1977 83 p refs
(AF Proj. 1367)
(AD-A053588; AFFDL-TR-77-37) Avail: NTIS HC A05/MF A01 CSCL 01/5

A method has been developed for determining the dynamic response of a flexible aircraft to runway roughness during takeoff or constant speed taxi. The equations that formulate the mathematical model have been programmed for a CDC 6600 digital computer and uses a Calcomp plotter for part of the program output. Three sets of runway elevation data are input to provide a forcing function at each landing gear. Three runway profiles measured at Washington National Airport, runway 36, were used to represent a typical commercial asymmetric profile. Three lines of profile were analytically generated to represent traversing a 1-cos dip at a 45 degree angle of approach. Several aircraft have been simulated with this program, each during a takeoff and a constant speed taxi. The data used to simulate the airplanes (McDonnell Douglas C-9A, Boeing 727-100, and an AMST) and the runway profile data used, are included in the appendix of this paper. Comparison of simulated results to limited experimental data was good. Peak vertical acceleration levels at the pilot's station were within 14%. The effect of the asymmetry of a profile on pilot's station vertical acceleration was significant providing the asymmetry of the profile was significant. Author (GRA)

N78-29088# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
PROCEEDINGS OF THE WORKSHOP ON ENGINE-AIRFRAME INTEGRATION SHORT-HAUL AIRCRAFT
S. N. B. Murthy May 1977 485 p refs Conf. held at the Naval Acad. Annapolis, Md.
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A053417; SQUID-PU-R1-78) Avail: NTIS HC A21/MF A01 CSCL 01/3

The principal concerns in the development of air-breathing propulsion, it is generally agreed, are fuel availability, engine-airframe-control integration, life-cycle reliability and environmental problems. In several respects integration presents the most challenging problems from the point of view of future airplanes, especially those in which multi-mission capability, maneuverability and special flight characteristics are demanded. Within the framework of military aircraft technology, short-haul carriers with V/STOL capability constitute one of the important classes of airplanes requiring urgent development. Integration problems are especially severe in this class of airplanes, and the solution of those problems largely determines the success of the airplanes to meet the projected mission objectives. This workshop was devoted to a discussion of the current status, the scope for developments and the needs in research in the general area of integration problems in short-haul, V/STOL problems. The Workshop was attended by about 63 persons who came from various institutions such as universities, industries, government laboratories and research funding agencies. GRA

N78-29089# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTER - ADVANCED TECHNOLOGY COMPONENT PROGRAM - ROTOR BLADE Final Report, Jul. 1971 - Jul. 1975
Sep. 1977 237 p refs
(Contract DAAJ01-71-C-0840)
(AD-A053423; USAAMRDL-TR-77-41) Avail: NTIS HC A11/MF A01 CSCL 01/3

This report reviews the development of the Model 301 Heavy Lift Helicopter rotor blade. It describes the design, structural analysis, testing, and manufacturing process of the HLH rotor blade. Author (GRA)

N78-29090# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
IMPROVING AIDED TRACK PERFORMANCE DURING PERIODS OF TRACKER SENSOR FAILURE BY UTILIZING A TARGET BODY FIXED COORDINATE SYSTEM M.S. Thesis
James G. Terry Dec. 1977 70 p refs
(AD-A053445; AFIT/GA/EE/77-6) Avail: NTIS HC A04/MF A01 CSCL 05/8

A new target acceleration model capable of improving the performance of an airborne aided track system during periods of tracker sensor failure was investigated. An aided track target prediction algorithm utilizing range and angle rate measurements was modified so that the target state estimates were propagated by integrating the estimated constant, body fixed acceleration. The modified algorithm performance was compared to the original by simulating three target paths. At specified times, all tracking sensors were turned off to simulate sensor failure. Each algorithm attempted to keep the target centered on the tracker boresight by extrapolating target position estimates without processing any measurements. RMS pointing errors were computed for the one second periods following each failure. During normal sensor operations, the performance of the modified algorithm was equivalent to the original. When the sensors were failed during the tracking of targets following a constant, body fixed acceleration, the modified algorithm generally produced smaller RMS errors. (After 2.8 seconds of filter operating time, the modified algorithm produced one third the RMS error of the original.) When sensor failure occurred during the tracking of targets following a rapidly oscillating path or traveling in a straight line under large linear accelerations, both algorithms produced equivalent RMS errors. The modified algorithm demonstrated the same sensitivity to measurement uncertainties as the original. Author (GRA)

N78-29091# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT MILITARY UTILITY AND FUNCTIONAL TESTS Final Report
Roy L. Miller 31 Jan. 1978 19 p Supersedes MTP-7-3-518; MTP-7-3-021; MTP-7-3-520
(AD-A053617; TOP-7-2-511; MTP-7-3-518; MTP-7-3-021;

MTP-7-3-520) Avail: NTIS HC A02/MF A01 CSCL 01/3

This document identifies testing methods and techniques necessary to determine the degree to which Army fixed-wing and rotary-wing aircraft meet the functions and performance requirements stated in the requirements documents. The procedures contained here cover testing relating to the weight and balance, ground handling, aircraft configuration, system configuration, aircraft performance, and operational characteristics and compatibility with related equipment. Author (GRA)

N78-29092# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

AIRCRAFT HAZARD DETECTION AND CONTROL UTILIZING AN AIRCRAFT DATA ACQUISITION SYSTEM Final Technical Report, Jul. 1970 - Jul. 1974

Duane G. Fox Dec. 1977 87 p refs

(AD-A054416; AFAPL-TR-77-77) Avail: NTIS HC A05/MF A01 CSCL 01/2

This report summarizes the results of an in-house program which demonstrates the feasibility of using an aircraft multiplexed data acquisition system for on-board aircraft hazard detection and control. The hazards of primary interest are fire, explosion, overheat, smoke, and explosive vapors. Hazard control involves system shutdown as well as activation of extinguishing systems and other active protective systems. This program involves both concept formulation and the design of breadboard hardware to demonstrate these concepts. Advanced aircraft will have multiplexed data acquisition systems with central computers for a variety of applications. Hazard detection is shown to be a small part of the total aircraft data system requirements. It is shown that hazard detection subsystem complexity and cost are reduced by using a data system and computer on a time-shared basis. Author (GRA)

N78-29093# Naval Air Engineering Center, Lakehurst, N.J.

TECHNICAL DATA REQUIREMENTS FOR SHIPBOARD AND SHOREBASED VERTICAL/SHORT TAKEOFF AND LANDING V/STOL AIRCRAFT

W. R. Clarke and F. C. Briggs, Jr. 26 Apr. 1978 68 p Revised

(AD-A054102; NAEC-AWS-571-REV-A) Avail: NTIS HC A03/MF A01 CSCL 01/3

This document defines the V/STOL aircraft technical data requirements for the Naval Air Systems Command and the Naval Air Engineering Center. The information and data shall cover both shipboard and shorebased operational areas of compatibility. Data submitted provides a central source of information to support the mission assignments with respect to shipboard suitability, ship/aircraft compatibility, aircraft spotting studies, aircraft proposal evaluation, and aviation safety. GRA

N78-29094# Boeing Vertol Co., Philadelphia, Pa.

HLH DRIVE SYSTEM Final Report

J. C. Mack Sep. 1977 455 p refs

(Contract DAAJ01-71-C-0840)

(AD-A054024; USAAMRDL-TR-77-38) Avail: NTIS HC A20/MF A01 CSCL 13/9

This report summarized the total Heavy Lift Helicopter Drive System Advanced Technology components (ATC) program. The program included the establishment of design criteria; the development testing of advanced technology components; the integration of these components into flight-weight, full-scale HLH transmissions; and the testing of the transmissions. The aft rotor and engine combining transmissions with associated drive shafting were designed, built, and tested. The transmission required to power the forward rotor was studied in the ATC program and was detail designed and fabricated under a later HLH prototype program. GRA

N78-29095# McDonnell Aircraft Co., St. Louis, Mo.

SUMMARY OF LANDING GEAR INITIAL FLAWS Interim Report, Sep. 1976 - Aug. 1977

W. T. Fujimoto and J. P. Gallagher Wright-Patterson AFB, Ohio AFFDL Dec. 1977 11 p

(Contract F33615-76-C-3133)

(AD-A054048; AFFDL-TR-77-125) Avail: NTIS HC A02/MF A01 CSCL 01/3

This report briefly summarizes the results of a field survey conducted by AFFDL and McDonnell Douglas at Ogden ALC (Hill AFB), 21-24 September 1976. The objective of the survey was to identify crack-like damage that had resulted in structural failures in landing gear components. This survey was based on depot metallurgical reports from 1971 to August 1976 and discussions with Ogden (ALC) depot maintenance engineering personnel and laboratory metallurgists. Author (GRA)

N78-29096# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

ASSESSMENT OF SERVICE LOAD EXPERIENCE USING AIDS-RECORDED DATA

J. B. deJonge and D. J. Spiekhout 5 Apr. 1977 34 p refs Presented at the 9th ICAF Symp., Darmstadt, West Ger., 11-13 May 1977

(NLR-MP-77011-U) Avail: NTIS HC A03/MF A01

Inspection periods and safe service lives of transport aircraft are based on an assumed average design load experience. Actual service loads may deviate appreciably from these assumptions. Fatigue related load data may be obtained on a routine basis from aircraft integrated data system recordings. The system in use by KLM, SAS, and Swissair for their Boeing 747s is described and the importance of careful data quality checking is stressed. Examples illustrate the highly relevant information with regard to aircraft usage and loading environment that may be obtained. Author (ESA)

N78-29048*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL RESULTS OF WINGLETS ON FIRST, SECOND, AND THIRD GENERATION JET TRANSPORTS

Stuart G. Flechner and Peter F. Jacobs *In its* CTOL Transport Technol., 1978 1978 p 553-569 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29050*# Boeing Commercial Airplane Co., Seattle, Wash.

APPLICATION OF WINGLETS AND/OR WING TIP EXTENSIONS WITH ACTIVE LOAD CONTROL ON THE BOEING 747

Robert L. Allison, Brian R. Perkin, and Richard L. Schoenman *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 625-646 refs (For primary document see N78-29046 20-01)

(Contract NAS1-14741)

Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29051*# Lockheed-California Co., San Diego.

DEVELOPMENT AND FLIGHT EVALUATION OF ACTIVE CONTROLS IN THE L-1011

J. F. Johnston and D. M. Urie *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 647-685 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29056*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUMMARY OF NASA LANDING-GEAR RESEARCH

Bruce D. Fisher, Robert K. Sleeper, and Sandy M. Stubbs *In its* CTOL Transport Technol., 1978 1978 p 773-804 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29058*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLIGHT EXPERIMENTS TO IMPROVE TERMINAL AREA OPERATIONS

Seymour Salmirs and Samuel A. Morello *In its* CTOL Transport Technol., 1978 1978 p 819-847 refs (For primary document see N78-29046 20-01)

Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29061*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SHORT-HAUL CTOL AIRCRAFT RESEARCH

Louis J. Williams *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 891-908 refs (For primary document

see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29062*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS IN SUPERSONIC CRUISE AIRCRAFT TECHNOLOGY
Cornelius Driver *In its* CTOL Transport Technol., 1978 1978 p 909-925 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N78-29064*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDIES OF ADVANCED TRANSPORT AIRCRAFT
A. L. Nagel *In its* CTOL Transport Technol., 1978 1978 p 951-982 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-29097# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE DESIGN OF AN OPTIMUM ALPHANUMERIC SYMBOL SET FOR COCKPIT DISPLAYS M.S. Thesis
Larry F. Bush Dec. 1977 108 p refs
(AD-A053447; AFIT/GE/EE/77-11) Avail: NTIS HC A06/MF A01 CSCL 01/4

The purpose of this study was to design an alphanumeric symbol set with improved legibility which could be implemented as a standardized set for cockpit displays. Pattern recognition theory was applied in which the two-dimensional, discrete, Fourier transform was used to obtain the feature space for each symbol. Spatial lowpass filtering techniques were employed and a decision rule was used based on the maximum nearest prototype Euclidian distance between symbols. A symbol change algorithm was developed in which symbols were moved away from their two closest neighbors in the transformed domain. Lincoln/Mitre, a highly legible font, was used as the initial prototype set. A new alphanumeric symbol set was designed with 18 changed symbols that had an overall greater distance spread between nearest neighbor symbols. The Lincoln/Mitre and a new test set were psychophysically tested with results indicating a 9.5% better performance for the changed symbols over the original Lincoln/Mitre symbols. Author (GRA)

N78-29098# Arinc Research Corp., Annapolis, Md.
AVIONICS PLANNING GUIDANCE: EXECUTIVE SUMMARY Annual Report
Apr. 1978 23 p refs
(Contract F04606-76-A-0087)
(AD-A054719) Avail: NTIS HC A02/MF A01 CSCL 01/3

This document presents guidance for the development, acquisition and support of Air Force avionics systems for the period FY 1978 through FY 1981. It relates threat and mission area analysis results to an avionics investment and support strategy. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N78-29099*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE COMPRESSOR EXIT STAGE STUDY. VOLUME 1: BLADING DESIGN Design Report, Oct. 1976 - Apr. 1977
D. C. Wisler Dec. 1977 67 p refs
(Contract NAS3-20070)
(NASA-CR-135391; Doc-R77AEG400-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21E

A baseline compressor test stage was designed as well as a candidate rotor and two candidate stators that have the potential of reducing endwall losses relative to the baseline stage. These test stages are typical of those required in the rear stages of advanced, highly-loaded core compressors. The baseline Stage A is a low-speed model of Stage 7 of the 10 stage AMAC compressor. Candidate Rotor B uses a type of meanline in the tip region that unloads the leading edge and loads the trailing edge relative to the baseline Rotor A design. Candidate Stator B embodies twist gradients in the endwall region. Candidate Stator C embodies airfoil sections near the endwalls that have reduced trailing edge loading relative to Stator A. Tests will be conducted using four identical stages of blading so that the designs described will operate in a true multistage environment. A.R.H.

N78-29100*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF AIR TEMPERATURE AND RELATIVE HUMIDITY AT VARIOUS FUEL-AIR RATIOS ON EXHAUST EMISSIONS ON A PER-MODE BASIS OF AN AVCO LYCOMING 0-320 DIAD LIGHT AIRCRAFT ENGINE: VOLUME 1: RESULTS AND PLOTTED DATA
Michael Skorobatckyi, Donald V. Cosgrove, Phillip R. Meng, and Erwin E. Kempe, Jr. Jul. 1978 109 p refs
(NASA-TM-73507-Vol-1; E-8916-2) Avail: NTIS HC E06/MF A01 CSCL 21E

A carbureted four cylinder air cooled 0-320 DIAD Lycoming aircraft engine was tested to establish the effects of air temperature and humidity at various fuel-air ratios on the exhaust emissions on a per-mode basis. The test conditions include carburetor lean out at air temperatures of 50, 59, 80, and 100 F at relative humidities of 0, 30, 60, and 80 percent. Temperature humidity effects at the higher values of air temperature and relative humidity tested indicated that the HC and CO emissions increased significantly, while the NOx emissions decreased. Even at a fixed fuel air ratio, the HC emissions increase and the NOx emissions decrease at the higher values of air temperature and humidity. B.B.

N78-29101*# Boeing Aerospace Co., Seattle, Wash.
PROPULSION/FLIGHT CONTROL INTEGRATION TECHNOLOGY (PROFIT) DESIGN ANALYSIS STATUS
Christopher M. Carlin and William J. Hastings Jul. 1978 415 p refs
(Contract NAS4-2391)
(NASA-CR-144875) Avail: NTIS HC A18/MF A01 CSCL 01C

The propulsion flight control integration technology (PROFIT) program was designed to develop a flying testbed dedicated to controls research. The preliminary design, analysis, and feasibility studies conducted in support of the PROFIT program are reported. The PROFIT system was built around existing IPCS hardware. In order to achieve the desired system flexibility and capability, additional interfaces between the IPCS hardware and F-15 systems were required. The requirements for additions and modifications to the existing hardware were defined. Those interfaces involving the more significant changes were studied. The DCU memory expansion to 32K with flight qualified hardware was completed on a brassboard basis. The uplink interface breadboard and a brassboard of the central computer interface were also tested. Two preliminary designs and corresponding program plans are presented. J.A.M.

N78-29102*# Boeing Aerospace Co., Seattle, Wash.
PROPULSION/FLIGHT CONTROL INTEGRATION TECHNOLOGY (PROFIT) SOFTWARE SYSTEM DEFINITION
Christopher M. Carlin and William J. Hastings Jul. 1978 351 p

(Contract NAS4-2391)
(NASA-CR-144876) Avail: NTIS HC A16/MF A01 CSCL 01C

The Propulsion Flight Control Integration Technology (PROFIT) program is designed to develop a flying testbed dedicated to controls research. The control software for PROFIT is defined. Maximum flexibility, needed for long term use of the flight facility, is achieved through a modular design. The Host program, processes inputs from the telemetry uplink, aircraft central computer, cockpit computer control and plant sensors to form an input data base for use by the control algorithms. The control algorithms, programmed as application modules, process the input data to generate an output data base. The Host program formats the data for output to the telemetry downlink, the cockpit computer control, and the control effectors. Two applications modules are defined - the bill of materials F-100 engine control and the bill of materials F-15 inlet control. L.S.

N78-29103*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
LONG-TERM CF6 ENGINE PERFORMANCE DETERIORATION: EVALUATION OF ENGINE S/N 451-380 Final Report
W. H. Kramer and J. J. Smith Aug. 1978 112 p
(Contract NAS3-20631)
(NASA-CR-159390) Avail: NTIS HC A06/MF A01 CSCL 21E

The performance testing and analytical teardown of CF6-6D engine serial number 451-380 which was recently removed from a DC-10 aircraft is summarized. The investigative test program was conducted inbound prior to normal overhaul/refurbishment. The performance testing included an inbound test, a test following cleaning of the low pressure turbine airfoils, and a final test after leading edge rework and cleaning the stage one fan blades. The analytical teardown consisted of detailed disassembly inspection measurements and airfoil surface finish checks of the as-received deteriorated hardware. Aspects discussed include the analysis of the test cell performance data, a complete analytical teardown report with a detailed description of all observed hardware distress, and an analytical assessment of the performance loss (deterioration) relating measured hardware conditions to losses in both specific fuel comsumption and exhaust gas temperature. A.R.H.

N78-29104*# General Electric Co., Cincinnati, Ohio.
DESIGN OF IMPACT-RESISTANT BORON/ALUMINUM LARGE FAN BLADE
C. T. Salemme and S. A. Yokel Jul. 1978 93 p refs
(Contract NAS3-21041)
(NASA-CR-135417) Avail: NTIS HC A05/MF A01 CSCL 21E

The technical program was comprised of two technical tasks. Task 1 encompassed the preliminary boron/aluminum fan blade design effort. Two preliminary designs were evolved. An initial design consisted of 32 blades per stage and was based on material properties extracted from manufactured blades. A final design of 36 blades per stage was based on rule-of-mixture material properties. In Task 2, the selected preliminary blade design was refined via more sophisticated analytical tools. Detailed finite element stress analysis and aero performance analysis were carried out to determine blade material frequencies and directional stresses. L.S.

N78-29105*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
EFFECT OF STEADY FLIGHT LOADS ON JT9D-7 PERFORMANCE DETERIORATION
A. Jay and E. S. Todd 9 Jun. 1978 103 p refs
(Contract NAS3-20632)
(NASA-CR-135407; PWA-5512-24) Avail: NTIS HC A06/MF A01 CSCL 21E

Short term engine deterioration occurs in less than 250 flights on a new engine and in the first flights following engine repair; while long term deterioration involves primarily hot section distress and compression system losses which occur at a somewhat slower rate. The causes for short-term deterioration are associated with clearance changes which occur in the flight environment. Analytical techniques utilized to examine the effects of flight loads and engine operating conditions on performance deterioration are presented. The role of gyroscopic, gravitational, and aerodynamic loads are discussed along with the effect of variations in engine build clearances. These analytical results are compared to engine test data along with the correlation between analytically predicted and measured clearances and rub patterns. Conclusions are drawn and important issues are discussed. A.R.H.

N78-29106# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
NUCLEAR Bi-BRAYTON SYSTEM FOR AIRCRAFT PROPULSION STUDY Final Report, 1 Jul. 1977 - 31 Jan. 1978
R. E. Thompson, B. L. Pierce, R. Calvo, J. A. Christenson, and H. D. Coe Mar. 1978 107 p refs
(Contract F33615-77-C-0116)
(AD-A054672; WAES-TNR-234) Avail: NTIS HC A06/MF A01 CSCL 21/5

Parametric and reference system definition studies were performed with respect to a new concept for a nuclear aircraft propulsion system. Also studied was a possible method for increasing the payload of a nuclear powered aircraft during wartime. The Bi-Brayton system concept for nuclear propulsion of aircraft has been examined and found to be feasible. The system has been shown to be one which minimizes the component developments required and one which can make effective use of reactor technologies that already exist. Cycle variants and component characteristics were parametrically evaluated and a reference system defined. Weight estimates indicate that with optimized reactor and shielding, the total powerplant and fuel weight for the Innovative Aircraft Design Study Task 2 reference aircraft could be reduced from that predicted for a NuERA liquid metal cooled reactor system coupled to an open Brayton cycle turbofan engine. The Bi-Brayton system combined with a compact gas-cooled (NERVA derivative) reactor was found to be a desirable system for nuclear aircraft propulsion and is recommended for consideration in any further studies of nuclear propelled aircraft. GRA

N78-29107# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
NOISE SUPPRESSION IN JET INLETS Interim Scientific Report, 1 Feb. 1977 - 31 Jan. 1978
Ben Zinn, William L. Meyer, and William A. Bell Feb. 1978 76 p refs
(Contract F49620-77-C-0066; AF Proj. 2307; Grant NSF GK-42159)
(AD-A054173; AFOSR-78-0696TR) Avail: NTIS HC A05/MF A01 CSCL 21/5

This report summarizes the work performed during the first year of a research effort to determine the sound fields associated with jet engine inlet configurations. A solution approach for axisymmetric bodies based upon the integral formulation of the wave equation has been developed. This solution approach circumvents the uniqueness problems which normally occur at certain frequencies when 'straight forward' solutions of the integral equation are obtained. A numerical method and a computer program for solving for the acoustic field associated with general inlet configurations and boundary conditions have also been developed. To evaluate the numerical method, computed and exact results are compared for a sphere and a finite length cylinder. For continuous boundary conditions, the agreement is within ten per cent over a range of nondimensional frequencies from one to ten. For discontinuous boundary conditions, the numerical errors increased by a factor of two. This report presents results for a given inlet configuration and the computed and exact solutions are shown to agree to within ten per cent over the nondimensional frequency range from one to ten. Author (GRA)

N78-29108# Mechanical Technology, Inc., Latham, N. Y.
TURBINE ENGINE ROTOR DYNAMIC EVALUATION. VOLUME 2: ENGINE AND TEST RIG BALANCING Final Report, 1 Apr. 1976 - 1 Nov. 1977
J. Davis, J. Tessarzik, and R. A. Rio Jan. 1978 52 p refs
(Contract F33615-75-C-2035)
(AD-A054533; MTI-76TR41-Vol-2; AFAPL-TR-76-81-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 21/5

As an extension of the original AFAPL Contact for determining the rotor-dynamics characteristics of eight jet engines within the Air Force inventory, Mechanical Technology Incorporated performed balancing demonstrations to show the applicability of combining dynamic characteristics and advanced balancing techniques to effectively reduce the vibration of production type machinery. Trim balancing procedures were performed on the TF30, TF41 and F100 jet engines which are currently in use on military aircraft. A very sensitive high-speed experimental test apparatus called the 'Rub Rig' was also used to show the benefits of multiplane-multispeed balancing using influence coefficients. All the balancing operations were highly successful, and showed the potential for using this type of balancing system to increase manpower productivity, reduce operating cost, and to provide a precision balanced rotor for production or laboratory use. Author (GRA)

N78-29109# Bendix Corp., South Bend, Ind. Energy Controls Div.
FLUIDIC PRESSURE RATIO SENSOR Final Report, 17 Jun. 1974 - 15 Dec. 1977
David C. Thomas and James M. Eastman 17 Feb. 1978 83 p refs
(Contract F33615-74-C-2068)
(AD-A054464; ECD-866-19292-R; AFAPL-TR-78-7) Avail: NTIS HC A05/MF A01 CSCL 21/5

Pressure ratio measurements are used to monitor and control core engine and by-pass air flow rates, compressor and fan performance, and engine thrust. The wide range of required operating pressure levels plus the severe environment (vibration and temperature) makes the use of discrete pressure sensors (with electronic ratio computation) extremely difficult. The fluidic approach avoids much of this difficulty and provides a simple, rugged, compact design. The design features, operation, bench evaluation testing and engine testing of a fluidic pressure ratio sensor are described. The sensor design is readily adaptable to measurement of any engine related pressure ratio, but it was specifically configured and developed for measuring burner inlet mach number (corrected air flow) for the Pratt and Whitney Aircraft ATEGG engine. The sensor was designed for direct engine mounting and uses compressor discharge air for the flow circuits. Sensor operation was tested for the range of burner inlet total pressures from 6.6 to 500 psia and sensor environmental temperatures from -65 to 750 F. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-29110*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
EFFECT OF CHORDWISE FORCES AND DEFORMATIONS AND DEFORMATIONS DUE TO STEADY LIFT ON WING FLUTTER Interim Report, 1 Apr. 1977 - 31 Mar. 1978
William Newsome Boyd Dec. 1977 260 p refs
(Grants NGL-05-020-243)
(AD-A053640; SU-DAAR-508; NASA-CR-156945; AFOSR-78-0856TR) Avail: NTIS HC A12/MF A01 CSCL 01/3

This investigation explores the effects of chordwise forces and deformations and steady-state deformation due to lift on the static and dynamic aeroelastic stability of a uniform cantilever wing. Results of this analysis are believed to have practical applications for high-performance sailplanes and certain RPV's. The airfoil cross section is assumed to be symmetric and camber bending is neglected. Motions in vertical bending, fore-and-aft bending, and torsion are considered. A differential equation model is developed, which included the nonlinear elastic bending-torsion coupling that accompanies even moderate deflections. A linearized expansion in small time-dependent deflections is made about a steady flight condition. The stability determinant of the linearized system then contains coefficients that depend on steady displacements. Loads derived from two-dimensional incompressible aerodynamic theory are used to obtain the majority of the results, but cases using three-dimensional subsonic compressible theory are also studied. The stability analysis is carried out in terms of the dynamically uncoupled natural modes of vibration of the uniform cantilever. GRA

N78-29053*# Boeing Commercial Airplane Co., Seattle, Wash.
ACTIVE CONTROLS TECHNOLOGY TO MAXIMIZE STRUCTURAL EFFICIENCY
James M. Hoy and James M. Arnold (Boeing Co., Wichita, Kans.) *In* NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 709-732 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-29111# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AIRFIELD PAVEMENT SMOOTHNESS REQUIREMENTS Final Report
Walter J. Horn Nov. 1977 132 p refs
(DA Proj. 4A7-62719-AT-40)
(AD-A050921; WES-TR-S-77-12) Avail: NTIS HC A07/MF A01 CSCL 01/5

This investigation was undertaken to determine the influence of airfield pavement surface roughness upon aircraft operations and to develop more realistic airfield pavement surface smoothness criteria for the construction of new airfield pavements based upon aircraft and aircraft crew operational requirements. Based upon a literature review of previous efforts in the area of pavement roughness, the human response criteria to whole body vibration were selected as the criteria for assessing the severity of aircraft response resulting from ground operations. Field tests were conducted using instrumented aircraft to measure the acceleration response of the aircraft at three locations within the fuselage during a series of ground operations. The profiles of the test site runways were also measured. The results of these tests provided a direct measure of the influence of a known runway surface on the response of the aircraft system and information for the verification of the computer code used during the subsequent analytical phase of the investigation. Aircraft response data were measured for both the B-52 and the Boeing 727 aircraft. GRA

N78-29112# Naval Air Engineering Center, Lakehurst, N.J. Dept of Engineering.
DEVELOPMENT OF CORROSION RESISTANT FASTENING SYSTEMS FOR AIRCRAFT CARRIER STEAM CATAPULTS Final Report, 3 Jun. 1975 - 30 Nov. 1977
Doreen L. Behmke and Edward Taylor 13 Apr. 1978 66 p
(AD-A053656; NAEC-ENG-7945) Avail: NTIS HC A04/MF A01 CSCL 13/5

A square drive recess was found to provide better properties for corrosion prone fasteners than a hex drive. Coating systems were evaluated by long term environmental tests simulating the deck near steam catapults. A thick coating of electroplated nickel and cadmium was found to provide superior protection to fasteners installed in steel or manganese bronze structure. Launch valve studs and nuts with a thick electroplated nickel coating were able to survive laboratory tests at 700 F in a corrosive environment. Inconel 718 alloy fasteners also survived the tests and provided superior properties. Author (GRA)

N78-29113# Naval Civil Engineering Lab., Port Hueneme, Calif.
NANSEN-DRIFT STATION PROJECT: REMOTE SEA-ICE RUNWAY CONSTRUCTION Final Report, Dec. 1976 - Dec. 1977

J. L. Barthelemy Apr. 1978 50 p refs
(AD-A054720; CEL-TR-865) Avail: NTIS HC A03/MF A01 CSCL 01/5

In the past, surface-flooding activities have been confined to areas near major military logistic centers. As a result, techniques developed for sea-ice runway construction relied extensively upon the use of heavy equipment to clear snow and position large stationary pumping equipment. At remote sites. such as that planned for the proposed Nansen Drift Station, requirements are different. Construction crews will be severely restricted as to their size and number of support equipment available, and they may be required to work concurrently at a number of scattered locations. A field-test program conducted by the Civil Engineering Laboratory at Barrow, Alaska, during March 1977 added a new dimension to surface-flooding technology. The exercises demonstrated the feasibility and capability of using small, lightweight pumps to prepare sections of a sea-ice runway. The water-handling equipment included two modified, highly portable, centrifugally driven trash pumps that had undergone preliminary low-temperature testing in the cold-chamber facilities at CEL.
Author (GRA)

N78-29114# National Technical Information Service, Springfield, Va.
AIRPORT DEVELOPMENT: SOCIAL AND ECONOMIC EFFECTS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1968 - May 1978
Edith Kenton May 1978 66 p Supersedes NTIS/PS-77/0441
(NTIS/PS-78/0447/9; NTIS/PS-77/0441) Avail: NTIS HC $28.00/MF $28.00 CSCL 01E

The reports cited in this bibliography involve many phases of airport development relating to local regions and communities including physical design, planning, construction, operations, policies, and impacts. Studies of feasibility, conversion-utilization of military facilities, economic impact, public attitudes, and cost effectiveness are cited. Municipal and rural relations, political issues, controversies, and technical assistance programs are described. This updated bibliography contains 61 abstracts, 21 of which are new entries to the previous edition. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-29115* National Aeronautics and Space Administration, Washington, D. C.
OFFICE OF SPACE TRACKING AND DATA SYSTEMS
Sep. 1978 12 p
(NASA-News-Release-78-129; P78-10132) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A brief overview of the Office of Space Tracking and Data Systems support functions is given along with a description of the Spaceflight Tracking and Data Network and the Deep Space Network. Preparations for upcoming missions, wideband communications, and Tracking and Data Relay Satellite Systems are discussed. J.M.S.

N78-29116*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE STATION SYSTEMS ANALYSIS STUDY, PROGRAM REVIEW
17 Jun. 1976 123 p
(Contract NAS8-31993)
(NASA-CR-150764) Avail: NTIS HC A06/MF A01 CSCL 22A

Mission selection, operational solar power, and public service platform of the space station systems analysis study program are included. J.A.M.

N78-29117*# Schafer (W. J.) Associates, Inc., Wakefield, Mass.
LASER DRIVEN LIGHT SAILS: AN EXAMINATION OF THE POSSIBILITIES FOR INTERSTELLAR PROBES AND OTHER MISSIONS
John D. G. Rather, Glenn W. Zeiders, and Karl R. Vogelsang Dec. 1976 42 p refs Prepared for JPL
(NASA-CR-157362; WJSA-76-26) Avail: NTIS HC A03/MF A01 CSCL 22A

A theoretical discussion of high energy laser propelled light sails is presented. Selection of sail materials, interstellar drag forces, beam pointing, flight velocity, probe mass, and radiation shielding are among the factors discussed. Interstellar probe missions and colonization of the solar system via the light sail are considered. J.M.S.

N78-29118*# American Inst. of Aeronautics and Astronautics, New York.
A CRITICAL REVIEW OF THE STATE OF FOREIGN SPACE TECHNOLOGY
Jerry Grey and Mireille Gerard 28 Feb. 1978 72 p refs
(Contract NASw-3098)
(NASA-CR-157363) Avail: NTIS HC A04/MF A01 CSCL 22A

A conference was held to exchange technical information in the area of space technology. Soviet system capability and technology both in Intersputnik and in the domestic Ekran system was discussed in detail. The thermonic power conversion system used in the Soviet Topaz nuclear power reactor was described in detail. Other areas of examination included: (1) Bioastronautics; (2) Space based industry; (3) Propulsion; (4) Astrodynamics; (5) Contact with extraterrestrial intelligence: and (6) Space rescue and safety. B.B.

N78-29119*# Rockwell International Corp., Downey, Calif. Space Div.
SPACELAB LEVEL 4 PROGRAMMATIC IMPLEMENTATION ASSESSMENT STUDY. VOLUME 1: REPRESENTATIVE PAYLOAD DEFINITION Final Report
May 1978 206 p ref 4 Vol.
(Contract NAS1-14909)
(NASA-CR-145348-Vol-1; SD-78-SR-0009-1) Avail: NTIS HC A10/MF A01 CSCL 22A

Four types of Spacelab payloads were analyzed; these were considered to be representative of the Spacelab traffic model. The payloads were: (1) space processing - a single pallet payload; (2) combined astronomy - a five pallet payload; (3) life sciences - a long module payload; and (4) advanced technology lab - a short module plus train payload. J.A.M.

N78-29120*# Rockwell International Corp., Downey, Calif. Space Div.
SPACELAB LEVEL 4 PROGRAMMATIC IMPLEMENTATION ASSESSMENT STUDY. VOLUME 2: GROUND PROCESSING REQUIREMENTS Final Report
May 1978 232 p 4 Vol.
(Contract NAS1-14909)
(NASA-CR-145348-Vol-2; SD-78-SR-0009-2) Avail: NTIS HC A11/MF A01 CSCL 22A

Alternate ground processing options are summarized, including installation and test requirements for payloads, space processing, combined astronomy, and life sciences. The level 4 integration resource requirements are also reviewed for: personnel, temporary relocation, transportation, ground support equipment, and Spacelab flight hardware. J.A.M.

N78-29121*# Rockwell International Corp., Downey, Calif. Space Div.
SPACELAB LEVEL 4 PROGRAMMATIC IMPLEMENTATION ASSESSMENT STUDY. VOLUME 3: OPTIMIZATION AND PROGRAMMATICS Final Report
May 1978 311 p 4 Vol.
(Contract NAS1-14909)
(NASA-CR-145348-Vol-3; SD-78-SR-0009-3) Avail: NTIS HC A14/MF A01 CSCL 22A

Alternate level 4 integration approaches were synthesized and evaluated to establish the most cost effective experiment integration approach. Program baseline system trade studies are described, as well as Spacelab equipment utilization. Programmatic analysis of the baseline program was evaluated; the 2/3 and 1/3 traffic models were also considered. J.A.M.

N78-29122*# Rockwell International Corp., Downey, Calif. Space Div.

SPACELAB LEVEL 4 PROGRAMMATIC IMPLEMENTATION ASSESSMENT STUDY. VOLUME 4: EXECUTIVE SUMMARY Final Report
Aug. 1978 106 p 4 Vol.
(Contract NAS1-14909)
(NASA-CR-145348-Vol-4; SD-78-SR-0009-4) Avail: NTIS HC A06/MF A01 CSCL 22A

The study objectives of the Spacelab level 4 analysis were defined, along with the most significant results. The approach used in the synthesis and selection of alternate level 4 integration is described; the options included distributed site, lead center, and launch site. Principal characteristics, as well as the functional flow diagrams for each option, are presented and explained. J.A.M.

N78-29123*# Desert Research Inst., Reno, Nev.
MODIFICATION OF THE CONTINUOUS FLOW DIFFUSION CHAMBER FOR USE IN ZERO-GRAVITY Final Report, 13 May 1975 - 30 Jun. 1978
Gary Keyser Aug. 1978 31 p refs
(Contract NAS8-31470)
(NASA-CR-150765) Avail: NTIS HC A03/MF A01 CSCL 22A

The design philosophy and performance characteristics of the continuous flow diffusion chamber developed for use in ground-based simulation of some of the experiments planned for the atmospheric cloud physics laboratory during the first Spacelab flight are discussed. Topics covered include principle of operation, thermal control, temperature measurement, tem-powered heat exchangers, wettable metal surfaces, sample injection system, and control electronics. Author

N78-29124# Indian Space Research Organization, Ahmedabad.
INDIAN NATIONAL COMMITTEE FOR SPACE RESEARCH (INCOSPAR) Report, 1 Apr. 1976 - 31 Dec. 1977
P. D. Bhavsar and P. N. Pathak 1978 73 p Presented at 21st COSPAR Meeting, Innsbruck, May - Jun. 1978
(Rept-16) Avail: NTIS HC A04/MF A01

Results are given of various experiments and studies conducted in the fields of meteorology, neutral upper atmosphere, ionosphere, geomagnetism, cosmic rays, solar physics, solar terrestrial relationships, X-ray and gamma ray astronomy, and lunar samples and meteorites. Applications of aerospace technology in the areas of satellite communication, remote sensing of earth resources, meteorological observations via aircraft and satellite, and satellite tracking are included. International cooperation in space exploration is discussed. J.M.S.

N78-29125# Council for Scientific and Industrial Research, Pretoria (South Africa).
SPACE RESEARCH IN THE REPUBLIC OF SOUTH AFRICA: REPORT TO COSPAR Annual Report
F. J. Hewitt May 1978 10 p
Avail: NTIS HC A02/MF A01

Results are given of various experiments and studies conducted in the areas of solar terrestrial physics and satellite remote sensing. Programs in ionospheric sounding, geomagnetism, cosmic rays, and whistlers, VLF, ELF, and auroral emissions are included along with satellite remote sensing of oceanographic parameters. Image processing of LANDSAT data to provide information for forest mapping, antarctic mapping, agricultural land use, and the study of coastal areas is summarized. J.M.S.

N78-29126# National Research Council of Canada, Ottawa (Ontario).
CANADA REPORT TO COSPAR
1978 32 p In ENGLISH and FRENCH Presented at the 21st Meeting, Innsbruck, Austria, Jun. 1978
Avail: NTIS HC A03/MF A01

Activities of the Canadian Government in the exploration and peaceful use of space are described with emphasis on magnetospheric studies and other international investigations, such as those to be conducted on space shuttle and Spacelab. Research projects being conducted at twelve university centers in support of these programs are reviewed. A.R.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-29127*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE GEOS-3 ORBIT DETERMINATION INVESTIGATION
V. L. Pisacane, A. Eisner, S. M. Yionoulis, R. J. McConahy, H. D. Black, and L. L. Pryor Jul. 1978 103 p refs
(NASA Order P-57606-G)
(NASA-CR-141441) Avail: NTIS HC A06/MF A01 CSCL 22A

The nature and improvement in satellite orbit determination when precise altimetric height data are used in combination with conventional tracking data was determined. A digital orbit determination program was developed that could singly or jointly use laser ranging, C-band ranging, Doppler range difference, and altimetric height data. Two intervals were selected and used in a preliminary evaluation of the altimeter data. With the data available, it was possible to determine the semimajor axis and eccentricity to within several kilometers, in addition to determining an altimeter height bias. When used jointly with a limited amount of either C-band or laser range data, it was shown that altimeter data can improve the orbit solution. B.B.

N78-29128# Science Applications, Inc., McLean, Va.
SUMMARY OF FIELD SUPPORT FOR SAMS VI AND MSV OPERATIONS Final Report, 1 Nov. 1975 - 30 Nov. 1977
John E. Cockayne 30 Nov. 1977 37 p
(Contract F19628-76-C-0131; AF Proj. 627A)
(AD-A054343; SAI-78-699-WA; AFGL-TR-0061) Avail: NTIS HC A03/MF A01 CSCL 16/3

Science Applications, Inc., was the contractor resonsible for the operations plan for the weather aspects of these test programs. This report summarizes the activities where SAI assisted AFGL in executing the weather operations plan. Author (GRA)

N78-29129# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
THE CONSTRUCTION OF THERMOSPHERIC DENSITY CORRECTION TABLES FOR USE IN SATELLITE TRAJECTORY AND LIFETIME PREDICTIONS Interim Report
Lawrence R. Sharp and Arthur B. Prag 26 Apr. 1978 25 p refs
(Contract F04701-77-C-0078)
(AD-A054341; TR-0078(3960-04)-4; SAMSO-TR-78-87) Avail: NTIS HC A02/MF A01 CSCL 22/3

In order to improve short-term ephemeris predictions and long-term satellite lifetime estimates, a set of correction tables has been provided. For the user, a ratio of a modified version of MSIS and DENSEL for a variety of input parameters is shown on these tables. Author (GRA)

N78-29130# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
A SEMINUMERICAL PROCEDURE FOR THE CALCULATION OF GEOSTATIONARY ORBIT PERTURBATIONS CAUSED BY THE SUN AND THE MOON [EIN HALBNUMERISCHES VERFAHREN ZUR BERECHNUNG DER STOERUNGEN EINER GEOSTATIONAEREN BAHN DURCH SONNE UND MOND]
M. C. Eckstein 20 Sep. 1977 25 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-485)
(DLR-IB-552-77/23) Avail: NTIS HC A02/MF A01

The general analytical expressions of lunar-solar perturbations on satellite orbits are very lengthy and complicated. In order to take advantage of possible simplifications in the special case of geostationary orbits, a semi-numerical method was applied to develop a perturbation theory for nearly geostationary satellites. Whereas the analytical form of the perturbation terms can be derived by geometrical considerations, the coefficients are determined by multiple Fourier analysis of the perturbation equations. The perturbations are expressed in terms of equinoxial elements to avoid singularities for zero eccentricity and inclination.

The final expressions generated by the computer program are printed and punched on cards in the form of program subroutines. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-29131*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.

EVALUATION OF THE PROPULSION CONTROL SYSTEM OF A PLANETARY ROVER AND DESIGN OF A MAST FOR AN ELEVATION SCANNING LASER/MULTI-DETECTOR SYSTEM

D. Knaub and S. Yerazunis Jul. 1978 145 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-157465; RPI-TR-MP-58) Avail: NTIS HC A07/MF A01 CSCL 22B

Vertical wheel loads, wheel speeds, and torque relationships are considered in the design of a propulsion system capable of responding to steering, slope climbing, and irregular local terrains. The system developed is applied to the RPI Mars roving vehicle. The mechanical system required to implement the elevation laser scanning/multidetector principle was the design and construction of a mechanical system for implementing the elevation scanning/multidetector principle is also discussed. A.R.H.

N78-29132*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.

ELEVATION SCANNING LASER/MULTI-SENSOR HAZARD DETECTION SYSTEM CONTROLLER AND MIRROR/MAST SPEED CONTROL COMPONENTS

J. Craig and S. Yerazunis Aug. 1978 135 p refs
(Grant NsG-7369)
(NASA-CR-157466; RPI-TR-MP-59) Avail: NTIS HC A07/MF A01 CSCL 22B

The electro-mechanical and electronic systems involved with pointing a laser beam from a roving vehicle along a desired vector are described. A rotating 8 sided mirror, driven by a phase-locked dc motor servo system, and monitored by a precision optical shaft encoder is used. This upper assembly is then rotated about an orthogonal axis to allow scanning into all 360 deg around the vehicle. This axis is also driven by a phase locked dc motor servo-system, and monitored with an optical shaft encoder. The electronics are realized in standard TTL integrated circuits with UV-erasable proms used to store desired coordinates of laser fire. Related topics such as the interface to the existing test vehicle are discussed. A.R.H.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-29133*# Boeing Aerospace Co., Seattle, Wash. Space Div.

SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. PART 3: PREFERRED CONCEPT SYSTEM DEFINITION

May 1978 364 p
(Contract NAS9-15196)
(NASA-CR-151746; D180-24071-1-Pt-3) Avail: NTIS HC A16/MF A01 CSCL 22B

A concise but complete system description for the preferred concept of the Solar Power Satellite System is presented. Significant selection decisions included the following: (1) single crystal silicon solar cells; (2) glass encapsulated solar cell balnkets; (3) concentration ratio 1; (4) graphite composite materials for primary structure; (5) electric propulsion for attitude control; (6) klystron RF amplifier tubes for the transmitter; (7) one kilometer diameter transmitter with a design trans mission link output power of 5,000 megawatts; (8) construction in low earth orbit with self-powered transfer of satellite modules to geosynchronous orbit; and (9) two-stage winged fully reusable rocket vehicle for transportation to low earth orbit. A.R.H.

N78-29134*# Ohio State Univ., Columbus. ElectroScience Lab.

THE OPTIMIZATION OF SELF-PHASED ARRAYS FOR DIURNAL MOTION TRACKING OF SYNCHRONOUS SATELLITES

D. M. Theobold and D. B. Hodge Jun. 1977 22 p refs
(Contract NAS5-22575)
(NASA-CR-156795; ESL-4299-5) Avail: NTIS HC A02/MF A01 CSCL 22A

The diurnal motion of a synchronous satellite necessitates mechanical tracking when a large aperture, high gain antenna is employed at the earth terminal. An alternative solution to this tracking problem is to use a self phased array consisting of a number of fixed pointed elements, each with moderate directivity. Non-mechanical tracking and adequate directive gain are achieved electronically by phase coherent summing of the element outputs. The element beamwidths provide overlapping area coverage of the satellite motion but introduce a diurnal variation into the array gain. The optimum element beamwidth and pointing direction of these elements can be obtained under the condition that the array gain is maximized simultaneously with the minimization of the diurnal variation. L.S.

N78-29135# Instituto de Pesquisas Espaciais, Sao. Jose dos Campos (Brazil).

TRACKING STATION FOR METEOROLOGICAL SATELLITES WITH A HIGH RESOLUTION RADIOMETER Final Report [ESTACAO RECEPTORA DE SATELITES METEOROLOGICOS COM RADIOMETRO DE MUITO ALTA RESOLUCAO]

Jose Roberto deOliveira and Marlene Elias 6 Jun. 1977 86 p refs In PORTUGUESE
(INPE-1040-RAE/027) Avail: NTIS HC A05/MF A01

The following topics were reviewed : (1) System definition and description; (2) Selection and acquisition of equipment; (3) Operation and utilization of data; and (5) Development of the high resolution radiometer. Transl. by B.B.

N78-29136# Air Force Geophysics Lab., Hanscom AFB, Mass.

ESTIMATES FROM SATELLITES OF WEATHER EROSION PARAMETERS FOR REENTRY SYSTEMS

John H. Conover and James T. Bunting 29 Nov. 1977 84 p refs
(AF Proj. 627A)
(AD-A053654; AFGL-TR-77-0260; AFGL-AFSG-377) Avail: NTIS HC A05/MF A01 CSCL 16/3

Techniques to estimate reentry vehicle weather erosion parameters from satellite measurements are described. The techniques were developed over a period of three years. An empirical approach was followed with simultaneous measurements of clouds by aircraft and satellite sensors in a series of 41 cases covering a great range of cloud conditions. For each case the aircraft measurements of clouds supplemented by surface weather reports and radar pictures were converted to profiles of hydrometeor densities vs altitude. The erosion parameters predict the amount of material eroded from a nosetip and the range error of the reentry system due to erosion by ice and water particles in the atmosphere. The erosion parameters were related to infrared and visible satellite imagery data from NOAA ITOS satellites by means of nonlinear equations. Equations were also developed to estimate total cloud mass and thickness from the same satellite data. Extensive applications and tests were made of the equations to estimate erosion parameters from satellite data. GRA

N78-29137# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

COMPILATION OF SCIENTIFIC RESULTS FROM THE SATELLITE OVI-17 Final Report

Hugo R. Rugge 2 Dec. 1977 318 p refs

(Contract F04701-77-C-0078)
(AD-A050483; TR-0078(3960-01)-1; SAMSO-TR-77-216)
Avail: NTIS HC A14/MF A01 CSCL 03/2

This compilation consists of all scientific papers based on data obtained wholly, or in part, from experiments flown on the OV1-17 satellite. The total number of papers is severely limited because only three of the seven aerospace experiments on board OV1-17 were able to obtain any useful data as a result of the inability of the satellite to achieve proper orientation. Even these three experiments received useful data for only relatively short time periods. In addition to the scientific papers, a brief description of the OV1-17 satellite is included. GRA

N78-29138# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
IRAS ON-BOARD SOFTWARE
G. J. Hameetman 3 Oct. 1977 22 p Presented at the Conf. of the Brit. Interplanet. Soc. on Computer Tech. for Satellite Control and Data Processing, Slough, Engl., 11-12 Oct. 1977
(NLR-MP-77037-U) Avail: NTIS HC A02/MF A01

The Infrared Astronomical Satellite (IRAS) will be launched in February 1981 for a mission of one year duration. The purpose of the mission is to procure a full sky catalog in the infrared waveband. The IRAS satellite will be equipped with an onboard computer system to control the satellite and to execute the measurements necessary to fulfill the mission. The software in the onboard computer must fulfill two conflicting requirements: to provide a reliable system that under no circumstances allows direct radiation from sun and earth into the experiment telescope; to provide a flexible measurement tool that will use the one year mission duration (dictated by the amount of cooling agent onboard) as efficient as possible. The onboard software system is described and the compromise that has been chosen to fulfill the conflicting requirements is discussed, i.e., the work division over read only and random access memory. Author (ESA)

N78-29139# National Environmental Satellite Service, Washington, D. C.
THE TIROS-N POLAR ORBITING-ENVIRONMENTAL SATELLITE SYSTEM
W. John Hussey Oct. 1977 32 p Presented at the 10th Session of the ESCAP/WMO Typhoon Committee, Tokyo, Japan, 28 Oct. 1977
(PB-280743/6; NOAA-78041213) Avail: NTIS HC A03/MF A01 CSCL 22B

The TIROS operational satellite (ITOS), launched in its current configuration with radiometers as NOAA-2 in October 1972, is the present type of NOAA polar orbiting operational satellite. Satellite and ground system capabilities of interest to the users of direct readout services from the system were examined in detail. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-29140* Solarex Corp., Rockville, Md.
TDRSS SYSTEM CONFIGURATION STUDY FOR SPACE SHUTTLE PROGRAM Final Report
Jun. 1978 88 p
(Contract NAS9-15303)
(NASA-CR-151751) Avail: Issuing Activity CSCL 22B

A study was conducted to assure that operation of the shuttle orbiter communications systems meet the program requirements when subject to electrical conditions similar to those which will be encountered during the operational mission. The functional requirements of the tracking data relay satellite system (TDRSS) hardware needed to construct a test system for TDRSS/space shuttle link were defined. The functional requirement task basically identifies the TDRSS functions needed to complete a TDRSS/space shuttle link with the existing space shuttle equipment. The existing TDRSS simulators and the proposed modification (both the space and the ground segment) were then examined and compared to the TDRSS specifications and/or calculated performance data. B.B.

N78-29141*# Rockwell International Corp., Downey, Calif. Space Div.
QUICK LOOK TEST REPORT: MPT STATIC FIRING NO. 2 TEST MPT-S2
12 Jun. 1978 173 p
(Contract NAS9-14000)
(NASA-CR-151814; SD-78-SH-0125) Avail: NTIS HC A08/MF A01 CSCL 20H

The three engine cluster was fired at 70 percent power level for a nominal 15 seconds to evaluate the integrated performance of the main propulsion system. Engine ignition occurred at approximately 1403 with the planned mainstage duration achieved for all three engines. Operation of all systems was as expected with the exception of the recirculation pumps. The pumps were started while the propellant loading was in fast fill, but they cavitated and lost head at the termination of fast fill. The pumps were subsequently restarted after pressurizing the tank and draining back propellant to get good quality. Post test inspection of the engines revealed some discoloration on the inside of the thrust chamber and distorted drain lines for engine #2. B.B.

N78-29142*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE ORBITER REACTION CONTROL SYSTEM INTERACTIONS WITH THE VEHICLE FLOW FIELD Final Report
J. R. Rausch May 1978 390 p refs
(Contract NAS9-14095)
(NASA-CR-151807; CASD-NAS-78-007) Avail: NTIS HC A17/MF A01 CSCL 01A

Test data on the effect of the interaction between the space shuttle orbiter rear-mounted reaction control system jets and the flow over the vehicle in the atmosphere are analyzed with particular attention to yaw angle effects. Masted tank-plus-orbiter jet interactions resulting from combinations of forward and rear-mounted reaction control jets being fired prior to external tank staging are also documented. The primary correlating parameter used for the mated data is a single-jet momentum ratioed to free-stream momentum. An analytic model for computing reaction control system interactions for all control combinations used for mated vehicle coast is included. A.R.H.

N78-29143*# TRW Defense and Space Systems Group, Houston, Tex.
CONCEPTS AND REQUIREMENTS FOR SHUTTLE/PAYLOAD ORBITAL OPERATIONS OF THE SPACE TRANSPORTATION SYSTEM Final Report
S. W. Wilson 30 Jun. 1978 15 p refs
(Contract NAS9-14723)
(NASA-CR-151808; TRW-28415-H008-RO-00) Avail: NTIS HC A02/MF A01 CSCL 22A

The results of studies and software development activities are summarized. Technical reports and memoranda are presented in a graphical history of contract activities and the expenditure of engineering manhours. Major topics and activities are: (1) flight phase standardization; (2) flight profile standardization; (3) maneuver targeting for solid rocket motors; (4) relative motion and RCS (Reaction Control System) jet flowfield plotting programs; (5) on-orbit aerodynamic models; (6) terminal approach strategy for payload retrieval/docking; (7) proximity navigation; and (8) desk-top flight simulator for proximity operations. A list of recommendations is also presented. G.Y.

N78-29144*# Rockwell International Corp., Downey, Calif. Space Div.
INTEGRATED GUIDANCE, NAVIGATION AND CONTROL VERIFICATION PLAN PRIMARY FLIGHT SYSTEM
May 1978 176 p
(Contract NAS9-14000)
(NASA-CR-151815; SD-78-SH-0141) Avail: NTIS HC A08/MF A01 CSCL 17G

The verification process and requirements for the ascent guidance interfaces and the ascent integrated guidance, navigation and control system for the space shuttle orbiter are defined as well as portions of supporting systems which directly interface

with the system. The ascent phase of verification covers the normal and ATO ascent through the final OMS-2 circularization burn (all of OPS-1), the AOA ascent through the OMS-1 burn, and the RTLS ascent through ET separation (all of MM 601). In addition, OPS translation verification is defined. Verification trees and roadmaps are given. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-29145*# Astro Research Corp., Carpinteria, Calif.
EXTRAVEHICULAR ACTIVITY TRANSLATION ARM (EVATA) STUDY Final Report
Peter R. Preiswerk and John R. Stammreich 14 Jul. 1978 126 p
(Contract NAS9-15579)
(NASA-CR-151755; ARC-TN-1064) Avail: NTIS HC A07/MF A01 CSCL 22B

The preliminary design of a deployable Extravehicular Activity Translation Arm (EVATA) assembly which will allow an EVA crewman to perform tasks in the vicinity of the External TNK (ET) umbilical doors and to inspect most of the underside of the shuttle spacecraft is reported. The concept chosen for the boom structure was the Astro Extendable Support Structure (ESS) which formed the main structure for the Synthetic Aperture Radar (SAR) Antenna System on the SEASAT A spacecraft. This structure is a deployable triangular truss. A comparison of the EVATA and the SEASAT A ESS is shown. The development of status of the ESS is shown. The satellite configuration, the stowed truss load path, and the envelope deployment sequence for the ESS are also shown. G.Y.

N78-29146*# Martin Marietta Aerospace, Denver, Colo.
EXPERIMENTAL INVESTIGATION OF CONTAMINATION PREVENTION TECHNIQUES TO CRYOGENIC SURFACES ON BOARD ORBITING SPACECRAFT
M. A. Hetrick, R. O. Rantanen, E. B. Ress, and J. F. Froechtenigt Aug. 1978 96 p refs
(Contract NAS2-9816)
(NASA-CR-152171; MCR-78-578) Avail: NTIS HC A05/MF A01 CSCL 22B

Within the simulation limitations of on-orbit conditions, it was demonstrated that a helium purge system could be an effective method for reducing the incoming flux of contaminant species. Although a generalized purge system was employed in conjunction with basic telescope components, the simulation provided data that could be used for further modeling and design of a specific helium injection system. Experimental telescope pressures required for 90% attenuation appeared to be slightly higher (factor of 2 to 5). Cooling the helium purge gas and telescope components from 300 to 140 K had no measurable effect on stopping efficiency of a given mass flow of helium from the diffuse injector. J.A.M.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-29147*# Hughes Research Labs., Malibu, Calif.
ENGINEERING MODEL 8-cm THRUSTER SUBSYSTEM Final Report, 20 Jun. 1974 - 20 Nov. 1976
B. G. Herron, J. Hyman, D. J. Hopper, W. S. Williamson, C. R. Dulgeroff, and C. R. Collett Jun. 1978 144 p refs
(Contract NAS3-18917)
(NASA-CR-135406) Avail: NTIS HC A07/MF A01 CSCL 21C

An Engineering Model (EM) 8 cm Ion Thruster Propulsion Subsystem was developed for operation at a thrust level 5 mN (1.1 mlb) at a specific impulse 1 sub sp = 2667 sec with a total system input power P sub in = 165 W. The system dry mass is 15 kg with a mercury-propellant-reservoir capacity of 8.75 kg permitting uninterrupted operation for about 12,500 hr. The subsystem can be started from a dormant condition in a time less than or equal to 15 min. The thruster has a design lifetime of 20,000 hr with 10,000 startup cycles. A gimbal unit is included to provide a thrust vector deflection capability of + or - 10 degrees in any direction from the zero position. The EM subsystem development program included thruster optimization, power-supply circuit optimization and flight packaging, subsystem integration, and subsystem acceptance testing including a cyclic test of the total propulsion package. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-29148 Columbia Univ., New York.
REMOTE-OXIDATION OF FLEXIBLE HYDROCARBON CHAINS Ph.D. Thesis
Jonathan Boon Rothbard 1978 238 p
Avail: Univ. Microfilms Order No. 7809923

Regioselective functionalization of flexible hydrocarbon chains was attempted by intramolecular photochemical cyclization of n-alkyl esters of p-benzoyl benzoate and by intermolecular reactions between benzophenone carboxylates and the hydrocarbon chains of straight chain amphiphiles. Selectivity was not obtained, but the experiments provided interesting data on the conformations hydrocarbon chains adopt in organic solvents and in aqueous micellar aggregates. Reliable and reproducible degradation sequences for converting benzhydrols to thioketals and mass spectral analyses of thioketals were developed for both systems. Dissert. Abstr.

N78-29149*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE POSSIBILITY OF NEGATIVE ACTIVATION ENERGIES IN BIMOLECULAR REACTIONS
Richard L. Jaffe Aug. 1978 26 p refs
(NASA-TM-78509; A-7537) Avail: NTIS HC A03/MF A01 CSCL 06C

The temperature dependence of the rate constants for model reacting systems was studied to understand some recent experimental measurements which imply the existence of negative activation energies. A collision theory model and classical trajectory calculations are used to demonstrate that the reaction probability can vary inversely with collision energy for bimolecular reactions occurring on attractive potential energy surfaces. However, this is not a sufficient condition to ensure that the rate constant has a negative temperature dependence. On the basis of these calculations, it seems unlikely that a true bimolecular reaction between neutral molecules will have a negative activation energy. A.R.H.

N78-29150# Wisconsin Univ. - Madison. Dept. of Chemistry.
CHEMICAL REACTIONS AND PROPERTIES OF ORGANOSILICON COMPOUNDS RELATED TO NEW MATERIALS Final Report, 1 Mar. 1974 - 31 Jan. 1978
Robert West 1978 15 p refs
(Grant AF-AFOSR-2644-74)
(AD-A053672; AFOSR-78-0757TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

The synthesis of cyclic and polymeric permethylpolysilanes from dimethyldichlorosilane has been studied. Inclusion of small amounts of phenylmethyldichlorosilane gives meltable, soluble silane polymers. Charge transfer complexes of permethylpolysilanes with pi-acceptors have been discovered and investigated. GRA

N78-29151# Boston Univ., Mass. Dept. of Chemistry.
INVESTIGATION OF THE TRIPLET STATES OF CHLOROPHYLLS Progress Report, 1 May 1977 - 30 Apr. 1978
Richard H. Clarke Jan. 1978 10 p refs
(Contracts EY-76-S-02-2570; E(11-1)-2570)
(COO-2570-3) Avail: NTIS HC A02/MF A01

Triplet state properties of solutions containing chlorophyll monomers and dimers were determined by optically detected magnetic resonance (ODMR) spectroscopy. Using a simple exciton formalism, the triplet state zero-field splittings and intersystem crossing rate constants found for the chlorophyll dimers and for the isolated chlorophyll molecule are utilized to determine the orientation of the pigment molecules in the dimer. The triplet state results indicate that water-linked chlorophyll dimers in vitro form single plane-parallel structures. Similar calculations using monomeric measurements by ODMR on bacteriochlorophyll and zero-field splittings for in vivo preparations of photosynthetic bacteria indicate that the dimer structures in vivo may be more complex than those observed in solution. ERA

24 COMPOSITE MATERIALS

Includes laminates.

N78-29152# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SWELLING OF COMPOSITE LAMINATES Final Report, 1 Sep. 1976 - 1 Sep. 1977
H. Thomas Hahn and R. Y. Kim Dec. 1977 53 p refs
(AF Proj. 2037)
(AD-A053742; AFML-TR-77-199) Avail: NTIS HC A04/MF A01 CSCL 11/4

The swelling behavior of a graphite/epoxy (AS/3501-5) is shown to be described by a model which is based on the assumption that the swelling is negligible until the moisture concentration reaches a threshhold value and then increases linearly thereafter. The model also provides a means of measuring the volume fraction of voids. The analytical results, which take into account the curing stresses, are compared with the experimental data for the transverse and thickness strains of symmetric laminates as well as for the warpage of unsymmetric laminates. The initial absorption on virgin specimens facilitates the subsequent diffusion and the residual stresses appear to be responsible for the absorption being slower than the desorption during the early stages of moisture conditioning. Warpage of unsymmetric laminates is discussed in light of the cracks found in constituent plies. Finally derived is a temperature-relative humidity relationship which renders the graphite/epoxy composite laminates free of residual stresses. Author (GRA)

N78-29153# Hercules, Inc., Magna, Utah.
COUPLING AGENTS: HME RESIN SYSTEM Final Report, 1 May - 31 Aug. 1977
L. G. Adams and R. E. Hoffman Dec. 1977 17 p
(Contract F33615-77-C-5124)
(AD-A054394; H400-12-1-053; AFML-TR-77-196) Avail: NTIS HC A02/MF A01 CSCL 11/4

Two approaches were taken to improve the SBS strength of HME/AS composites. First, attempts were made to react a number of organo-titanates, epoxides, and modified polybutadiene (PB) epoxides with reactive sites on the graphite fiber surface and then to react, or couple, with the matrix HME resin. Epon 834 (a bisphenol A type epoxy resin), allylglycidyl ether, and a reaction product of C-1000 PB and ERE-1359 epoxy resin produced very slight increases in SBS strengths of HME composites when used as AS fiber sizing. Second, attempts were made to reinforce the HME resin with three finely divided fillers: Vulcan 9A32 carbon black, HiSil 233 hydrated silica, and HR-600 polyimide resin. However, these fillers severely degraded composite strengths. Low profile modifiers, developed to reduce cure shrinkage in polyester resins, were evaluated for this purpose in the HME resin system but were found to be incompatible. It is unlikely that all of the many approaches to form primary chemical bonds between the HME matrix and graphite fiber failed, yet no significant improvement in SBS was achieved over untreated fiber during this program. The possibility that a low cohesive strength in the HME matrix was the problem was briefly explored using fillers, also without success. GRA

N78-29154# Naval Research Lab., Washington, D. C. Polymeric Materials Branch.
HIGH PERFORMANCE COMPOSITES AND ADHESIVES FOR V/STOL AIRCRAFT Annual Report, 1 Sep. 1976 - 31 Aug. 1977
Willard D. Bascom and Luther B. Lockhart, Jr. Feb. 1978 148 p refs
(WF54593201)
(AD-A054637; AD-E000155; NRL-MR-3721; AR-2) Avail: NTIS HC A07/MF A01 CSCL 11/4

An interdisciplinary program has been undertaken to address the composite and adhesive materials requirements of V/STOL aircraft. The primary tasks are to develop and characterize high modulus, high toughness resins with use temperatures of 350 F to 450 F or higher, to develop fabrication technology for newly developed resin matrices for graphite-fiber reinforced composites, to develop composite failure criteria for design optimization and to establish appropriate quality control parameters. The principle accomplishments during the reporting period have been to obtain commercial sources for the C10 phthalocyanine resin and composite prepreg of this resin with graphite fiber, to define the fracture behavior of a variety of commercial and in-house high performance resins, to establish quality control methods for the phthalocyanine resins based on nmr spectroscopy, to formulate a polyimide-based resin curable by ionizing radiation and demonstrate that graphite-fiber composites can be fabricated using ionizing radiation, and to show that failure criteria for composites determined with small scale test coupons accurately predict failure of flaws in a box-beam substructure. GRA

N78-29155# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
THERMODYNAMIC PROPERTIES OF SeS
Ming-Der Huang Dec. 1977 20 p refs
(Contract W-7405-eng-48)
(LBL-6994) Avail: NTIS HC A02/MF A01

Mass spectrometry and Knudsen effusion experiments were used to study the equilibrium partial pressure of SeS formed by reaction of S2 and Se2 which were produced by thermally decomposing a mixture of In2S3 and In2Se3 in a Knudsen effusion cell. The heat of formation of SeS(g) was determined by the second law method to be 0.6 plus or minus 3 kcal/mole. The entropy of formation of SeS(g) was calculated from spectrographic data in Ahmed and Barrow to be 1.5 cal/degree mole at 298 deg K. ERA

N78-29156# California Univ., Livermore. Lawrence Livermore Lab.
DIFFUSION WELDING MULTIFILAMENT SUPERCONDUCTIVE COMPOSITES
Charles E. Witherell 27 Feb. 1978 43 p refs Presented at the 59th Am. Welding Soc. Ann. Meeting, New Orleans, 4 Apr. 1978
(Contract W-7405-eng-48)
(UCRL-80436; Conf-780406-3) Avail: NTIS HC A03/MF A01

Diffusion welding is shown to be a feasible method for joining composites of niobium titanium superconductor alloy filaments in a pure copper matrix. Good results were repeatedly obtained using 15 deg scarf joints welded with externally heated tooling and simple uniaxial compression loading in a conventional hydraulic press. Weld cycles of less than one hour total elapsed time were readily attainable. Through proper closed-die design, it was possible to increase welding pressure sufficiently to use relatively low temperatures to coincide with the optimum aging heat treatment of the superconductor alloy. This temperature limitation is important to retain optimal superconductor properties. In the welded joints made under optimum conditions, there is bonding of all constituents, including superconductor filaments. Weld tooling which effectively contains the relatively fluid matrix, and resists deformation during repeated weld cycles, is essential to the successful application of the diffusion welding process to these composites. ERA

N78-29157# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
NON HOOKEAN BEHAVIOR IN THE FIBER DIRECTION OF CARBON FIBER COMPOSITES AND THE INFLUENCE OF FIBER WAVINESS ON THE TENSILE PROPERTIES
W. H. M. vanDreumel and J. L. M. Kamp Jul. 1977 20 p refs
(VTH-LR-251) Avail: NTIS HC A02/MF A01

Tensile behavior in the fiber direction of unidirectional carbon fiber reinforced plastic is assumed to be linearly elastic up to failure. Some authors distinguish a primary and a secondary part in the stress-strain curve, each showing Hookean behavior. Experimental results show that Young's modulus of laminates increases proportionally with the tensile stress, as found for single non-impregnated fibers. An empirical relation between Young's modulus and the tensile stress was derived and the influence of fiber misalignment on this relation examined. The influence of fiber misalignment on the tensile strength and Poisson's ratio is discussed. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N78-29158 California Inst. of Tech., Pasadena.
EXPERIMENTAL STUDIES OF INTERFACIAL ELECTROCHEMISTRY Ph.D. Thesis
Bruce Alan Parkinson 1978 215 p
Avail: Univ. Microfilms Order No. 7810783

The structure of the diffuse double layer at positive electrode charges in dilute perchlorate, fluoride, chloride and bromide electrolytes is inferred from the kinetics of oxidation of the Eu(+2) (V+2) and Co(NH3)6+(+3) cations. Diffuse layer potentials were calculated from the measured kinetics. The adsorption of thioethercarboxylate ligands and complexes formed by these ligands with white metals (Pb(+2) in particular) on a mercury surface is investigated. The large adsorption of metal cations measured in potential regions is attributed to the formation of a monolayer of polymeric surface phase which has a structure not unlike those observed in the molecular crystals of analogous compounds. Dissert. Abstr.

N78-29159 Georgia Inst. of Tech., Atlanta.
INVESTIGATIONS INTO THE DETERMINATION OF TRACE LEVELS OF IRON, PART 1: A FIELD METHOD FOR THE DETERMINATION OF EDTA IN NATURAL WATER Ph.D. Thesis
John Josep Tice, IV 1978 131 p
Avail: Univ. Microfilms Order No. 7810006

A number of approaches are investigated for the determination of iron after its extraction from 6 F hydrochloric acid into MIBK. Application of the Walden reductor for the in situ reduction and complexation of iron(III) in the mediated MIBK is reported. The determination of the iron was based upon the photometric titration of iron(II) ferrozine with cerium(IV). A literature survey of the recent methods for the determination of EDTA and related compounds in aqueous solutions is presented in tabular form. A method for the determination of EDTA on the trace level in the presence of ten metal ions is presented. Dissert. Abstr.

N78-29160 Florida Univ., Gainesville.
PULSED LASER-EXCITED FLUORESCENCE Ph.D. Thesis
Stephan John Weeks 1977 176 p
Avail: Univ. Microfilms Order No. 78-10995

Laser-excited atomic fluorescence flame spectrometry with a pulsed nitrogen laser pumped tunable dye laser was investigated especially in terms of improvement of the detection limits. The detection limits for Ag, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, In, Li, Mg, Mn, Na, Ni, Pb, Sr, and Tl in an air-acetylene flame are evaluated in the cases of both resonance and nonresonance atomic fluorescence lines. In addition, the utility of this laser fluorescence system in molecular flame fluorescence studies was examined. Molecular fluorescence spectra of BaO, BaOH, and BaCl in an airacetylene flame have been investigated and compared to the flame emission spectra of the same species. A preliminary energy level diagram is proposed for CaOH. Results are also given for SrOH. Dissert. Abstr.

N78-29161 Columbia Univ., New York.
IRREVERSIBLE THERMODYNAMIC ANALYSIS OF ELECTROPHORETIC LIGHT SCATTERING EXPERIMENTS Ph.D. Thesis
Lawrence Tim Friedhoff 1978 135 p
Avail: Univ. Microfilms Order No. 7811130

The electrophoretic light scattering spectrum for the two ion and three ion case is analyzed assuming thermal and pressure fluctuations can be ignored. The results reduce to the appropriate classical electrophoresis results in the appropriate limit. The spectrum for the two ion case in which temperature and pressure fluctuations are important is also calculated. It is found that the presence of the external electric field shifts all of the peaks in the spectrum. The magnitude of this shift is computed in various limits. Dissert. Abstr.

N78-29162 Minnesota Univ., Minneapolis.
STUDIES IN THE SYNTHESIS OF CONTROL STRUCTURES FOR CHEMICAL PROCESSES Ph.D. Thesis
Manfred Morari 1977 219 p
Avail: Univ. Microfilms Order No. 78-09705

The problem of synthesizing the control structure of a complete chemical plant was addressed. The multilayer-multiechelon concept was used to decompose the overall problem into manageable subproblems using developed quantitative criteria to classify disturbances (in order to split the control task into an optimizing and a regulatory one) and to estimate the loss caused by insufficient coordination. Feedback optimizing control is discussed, and a criterion for its attractiveness is derived. Alternative regulatory control structures were generated by an algorithmic procedure based on extensions of the concepts of structural controllability and observability. The method required simple structural models only and included the development of the usually encountered feedback structures where the number of control inputs was equal to the number of measured outputs. Dissert. Abstr.

N78-29163 Illinois Univ. at Urbana-Champaign, Urbana.
THE HIGH PRESSURE KINETICS OF A HALIDE EXCHANGE REACTION Ph.D. Thesis
Paul Gregory Glugla 1976 202 p
Avail: Univ. Microfilms Order No. 7811239

The reaction that was chosen for study was the halide exchange reaction in which an iodine ion reacts with a n-propyl bromide molecule (1(-) + nPrBr yields Br(-) + Pr1). The rate constant for this reaction was measured from 1 atm. to 1500 atm. in 4-methly-2-pentanone, acetone, acetonitrile, sulfolane, and propylene carbonate. The partial molal volumes of the reactants were measured with a number of different dilatometric techniques. With these volumes and the activation volume, the partial molal volume of the transition state was calculated. As a result of observations it is believed that the ionic reactants is much more important in determining the kinetic solvent effect than is the transition state. The solvent effect on the rate constants, equilibrium constants, and partial molal volume is qualitatively explained by examining the microscopic nature of the solvent.
Dissert. Abstr.

N78-29164 Georgia Inst. of Tech., Atlanta.
NEW METHODS FOR IMPROVING SENSITIVITY IN TRACE ANALYSIS Ph.D. Thesis
Julius Virgil Hornstein 1978 146 p
Avail: Univ. Microfilms Order No. 7810004

Several approaches for increasing the sensitivity of photometric determinations are explored. These approaches are based on increasing the magnitude of the parameters: absorptivity; (1) effective path length; (2) effective concentration, and (3) Lambert-Beer's Law, A = abc. Each of the approaches provided increased sensitivity and it is felt that the techniques developed can be successfully applied to practical analysis when determining lower concentrations or using smaller samples or both.
Dissert. Abstr.

N78-29165 Illinois Univ. at Urbana-Champaign, Urbana.
CRITICAL EVALUATION OF SOME ATOM RESERVOIRS FOR ATOMIC FLUORESCENCE SPECTROSCOPY Ph.D. Thesis
Steven Jaye Martin 1978 176 p
Avail: Univ. Microfilms Order No. 7811264

Several atom reservoirs were constructed and tested so as to provide comparative evaluation of their analytical utility, and to quantitate any compromises incurred in their use. For the assessment of analytical utility, the concentration limits of detection, sensitivity, precision, long term stability, extent of matrix interference, and other characteristics are presented. Minor and trace elements in several real world samples were determined by using premixed H2/O2/Ar and argon-separated C2H2/O2/Ar flames in the multielement atomic fluorescence spectrometer. For these analyses, the extent of the matrix interferences encountered with the different flames were compared. In the samples, NBS standard orchard leaves, fly ash, and blood serum were included. The excellent analytical results that can be obtained simply and rapidly on real world samples by this atomic fluorescence system should clearly demonstrate the feasibility of this technique for practical analysis. Dissert. Abstr.

N78-29166 New Orleans Univ., La.
NON-FLAME ATOMIC ABSORPTION SPECTROSCOPY EMPLOYING A WIRE LOOP ATOMIZER Ph.D. Thesis
John Francis Molina 1977 167 p
Avail: Univ. Microfilms Order No. 7809780

Wire loop, non-flame atomizers are developed and studied. The atomizers consist of a tungsten-rhenium alloy wire mounted on a grade C phenolic support. A discussion concerning theoretical considerations in the atomizer design include the length of the brass enclosure surrounding the loop and the sheath gases employed. Brief studies indicate that hydrogen aids in reduction during the atomization process. A newly designed wire loop atomizer which includes a glass absorption cell is employed for arsenic and selenium analysis. The affects on signal sensitivity by wire loop geometry, gas flow rates, optical alignment and interferences are discussed. Modifications to the electronics were made. Several metals were investigated. A variety of samples were analyzed. Microwave oven digestion procedures for biological samples employing concentrations of hydrochloric acid and 30% hydrogen peroxide are developed. Dissert. Abstr.

N78-29167 North Carolina Univ. at Chapel Hill.
INTRAMOLECULAR INTERACTIONS IN MASS SPECTRAL FRAGMENTATION REACTIONS Ph.D. Thesis
Carol Elaine Greenberg Parker 1977 257 p
Avail: Univ. Microfilms Order No. 7810491

The INDO/CNDO (Intermediate Neglect of Differential Overlap/Complete Neglect of Differential Overlap) molecular orbital theory was used to examine ion structures, charge densities, and bond orders of a series of organic compounds. These results were correlated with experimental results, Hammett-sigma relationships, and Quasi-Equilibrium Theory predictions. Substituted acetophenones were used to examine the minimum energy of the neutral molecule and the molecular ion. Further studies on intramolecular rotation, using hydrogen/deuterium scrambling as evidence for rotation, were performed using benzoic acid and salicylic acid as model compounds. Hydrogen/deuterium scrambling was also studied in the ethane system.
Dissert. Abstr.

N78-29168 Michigan State Univ., East Lansing.
COMPUTER ASSISTED CHARACTERIZATION OF A FILAMENT ELECTROTHERMAL ATOMIZER Ph.D. Thesis
David Norman Baxter 1977 368 p
Avail: Univ. Microfilms Order No. 78-10023

Three specific investigations, which employed computer controlled instrumentation, were performed with an atomizer, the graphite braid. Scanning electron microscopy with X-ray microprobe fluorescence was used to examine the physical appearance and evolution of graphite braids as they receive and atomize analytical samples. Changes which occur in braids as they are in service, and some of the behavior exhibited by deposited samples are observed and discussed. The control of temperature in electrothermal atomic spectrometry is an extremely important parameter. A method known as radiation programming, in which the intensity of the blackbody emission from the incandescent atomizer is the control signal, is a superior method of temperature regulation. Temperature calibration of the atomizer is also illustrated. Two dimensional spatial profiles of atomic concentrations above the atomizer were acquired. Dissert. Abstr.

N78-29169 North Carolina Univ. at Chapel Hill.
SEARCH AND DIFFERENTIATION ALGORITHMS AND INFORMATION THEORY APPLIED TO CHEMICAL SPECTROSCOPIC AND BIOCHEMICAL DATA Ph.D. Thesis
James Andries DeHaseth 1977 229 p
Avail: Univ. Microfilms Order No. 7810433

The volume of chemical and biochemical data is ever increasing, primarily due to improved data collection techniques coupled with efficient instrumentation. The amount of data is sufficiently large that often pertinent information cannot be extracted without efficient data handling techniques. In large data collections two separate goals are sought; one is to be able to recover specific information or sets of information as discrete entities from within the collection; the other is to extract information that may not be contained in any single entry within the data collection itself. Several methods of obtaining information from large chemical spectroscopic and biochemical data bases are presented. Dissert. Abstr.

N78-29170 California Inst. of Tech., Pasadena.
SOME INVESTIGATIONS IN THEORETICAL AND EXPERIMENTAL ELECTROCHEMISTRY Ph.D. Thesis
James Brian Flanagan 1978 276 p
Avail: Univ. Microfilms Order No. 78-10782

The analytical consequences of adsorption of reactants at the electrode surface with dc., normal and differential pulse polarography are reported. The effects of nonlinear adsorption isotherms and uncompensated resistance on current-potential response was calculated. The electrochemical behavior of molecules with more than one center for electron transfer are presented. Data analysis techniques for large step coulostatics in the study of electron transfer kinetics are discussed. A method for the use of a numerically generated function as the basis function for nonlinear regression is also discussed. A study of alternative methods of small step coulostatic data analysis is presented. Dissert. Abstr.

N78-29171 Kansas State Univ., Manhattan.
APPLICATION OF NEGATIVE CHEMICAL IONIZATION MASS SPECTROMETRY TO THE ANALYSIS OF BOVINE TISSUE FOR CHLORODIBENZO-p-DIOXINS AND RELATED COMPOUNDS Ph.D. Thesis

Marlin Dean Friesen 1977 205 p
Avail: Univ. Microfilms Order No. 7811416

Polychlorinated dibenzo-p-dioxins comprise one of the most toxic and teratogenic classes of compounds found in the environment. The application of a rapid extraction and clean-up method in combination with dioxin quantitation by gas chromatography-methane negative chemical ionization mass spectrometry (MNCI-MS) is described. The MNCI-MS method is sensitive for most dioxin isomers that analyses requiring the detection of 10 to 100 pg of material injected onto the gas chromatographic column. The analysis of two sets of liver and fat tissue samples from a dairy herd housed in a barn constructed of pentachlorophenol-treated lumber is reported. A liver sample and a sample of wood taken from the barn housing the cattle were compared by MNCI-MS. Similar dioxin and furan isomers were detected in both samples; however, higher chlorinated dioxin isomers were found to be more prominent in the wood sample than in the tissue sample. Dissert. Abstr.

N78-29172 Michigan State Univ., East Lansing.
BASIC AND PRACTICAL INVESTIGATIONS OF AUTOMATED STOPPED-FLOW MIXING SYSTEMS Ph.D. Thesis
Floyd James Holler 1977 195 p
Avail: Univ. Microfilms Order No. 78-10066

Several elements of automated stopped-flow mixing systems were investigated and are described. A critical study of temperature effects in stopped-flow mixing systems was carried out. Special emphasis was placed on the determination of the signs and magnitudes of the temperature changes which occur before and during mixing when the modules are maintained at 20-30 C. The computerized temperature circuit utilized is described in detail. The operation and calibration of the circuit are presented, and a brief description of the software which was used for data acquisition and analysis is given. Two new designs for a computer controllable, stepping motor driven buret are presented, and the operating characteristics of the prototype models are presented. Dissert. Abstr.

N78-29173 Baylor Univ., Houston, Tex.
THE STRUCTURE OF AMORPHOUS HYDROUS ERBIUM OXIDE GELS Ph.D. Thesis
Herbert Arthur Wolcott 1977 126 p
Avail: Univ. Microfilms Order No. 7810410

The structures of two amorphous gels with compositions Er2O3 + 9.07 H2O and Er2O3 + 5.56 H2O + 0.66 HNO3 were investigated by X-ray diffraction techniques. Models were found which produce reasonably good agreements between the calculated and experimental X-ray patterns and between the pair function and radial distribution function curves. The average local order in both gels, that is the nearest neighbor configuration, corresponds closely to that found for the monoclinic crystalline phase, Er4O2(OH)8HNO3. This implies the existence of the new amorphous compound, Er4O2(OH)8, since one of the gels was made without nitrate. The average long range order in the gel containing the nitrate extends through a cube of approximately 18 A on a side, and extends through a similar rectangular solid of approximately 7 A in height in the gel without the nitrate. Dissert. Abstr.

N78-29174 Illinois Univ. at Urbana-Champaign, Urbana.
THERMODYNAMICS OF OXYGEN IN SOLID SOLUTION IN VANADIUM AND NIOBIUM-VANADIUM ALLOYS Ph.D. Thesis
Gary Lee Steckel 1978 127 p
Avail: Univ. Microfilms Order No. 7811297

A thermodynamic study was made of the vanadium-oxygen and niobium-vanadium-oxygen systems utilizing the solid state galvanic cell technique. Investigations were made with a ThO2/Y2O3 electrolyte over the temperature ranges 700-1200 C (973-1473K) for the binary system and 650-1150 C (923-1423K) for the ternary system. The activity of oxygen in vanadium obeys Henry's law for temperatures. For higher concentrations, the activity coefficient shows positive deviations from Henry's law. The oxygen activity, entropy, and enthalpy can be described over the entire composition range by interstitial solution theories when it is assumed that second nearest neighbor oxygen-oxygen interaction energies are of the same magnitude as the first nearest neighbor interactions. The terminal solubility of oxygen in vanadium was determined. Dissert. Abstr.

N78-29175 Carnegie-Mellon Univ., Pittsburgh, Pa.
A MECHANISM FOR ULTRALOW INTERFACIAL TENSION IN SYSTEMS CONTAINING MICROEMULSIONS: THEORETICAL CONSIDERATIONS AND EXPERIMENTS WITH ULTRACENTRIFUGE Ph.D. Thesis
Rei-Nan Hwan 1978 131 p
Avail: Univ. Microfilms Order No. 78-11503

A theory of ultralow interfacial tensions and their relation to phase separation in micellar solution was developed. The theory predicted that interfaces having very low tensions can be produced when a micellar solution separated into a micelle-rich and a micelle-lean phase. For phase separation to occur under reasonable conditions, the micelles must contain enough solubilized oil or water to be about 100 A in diameter or larger. The conditions for phase separation and the composition of the phases in equilibrium were also predicted by the theory. Interfacial tension was calculated by adapting Cahn and Hilliard's approach. Results showed that interfacial tensions can be .01 dyne/cm or lower even when the system is far from a consolute point. Predictions of the theory were in general agreement with the data of Healy et al., on low interfacial tensions in oil-water systems with a synthetic petroleum sulfonate surfactant. Dissert. Abstr.

N78-29176 Massachusetts Univ., Amherst.
STUDIES OF SOLID-CATALYZED SYSTEMS SUBJECT TO CATALYST DEACTIVATION AND DIFFUSIONAL LIMITATIONS Ph.D. Thesis
Sarangan Krishnaswamy 1978 373 p
Avail: Univ. Microfilms Order No. 78-10729

Simple mathematical models are presented that describe the interaction between diffusion and deactivation for decreasing conversion (constant temperature and feed rate) mode of reactor operation. Experimental deactivation data, taken on the decomposition of hydrogen peroxide by immobilized catalase, were used to test the predictions of the theoretical model. Extension of this analysis to concentration-dependent decay is discussed. The possibility of such concentration-dependent deactivation disguising the kinetics of the primary reaction was examined. Mathematical models were also developed to describe constant conversion mode of reactor operation. The models predicted temperature-time profiles for constant conversion of reactant, as well as diffusional implications on such profiles. Alternative policies of reactor operation that aim to improve the yield of intermediates in complex reaction schemes are presented. Dissert. Abstr.

N78-29177 State Univ. of New York, Buffalo.
STATE ESTIMATION AND OPTIMAL CONTROL OF DISTRIBUTED PARAMETER SYSTEMS Ph.D. Thesis
Gerhard Karlheinz Lausterer 1978 602 p
Avail: Univ. Microfilms Order No. 7810638

Theoretical and practical aspects of the application of distributed parameter state estimation and control theory were investigated. The problem of observability and controlability (CO) of linear, multidimensional distributed parameter systems (DPS) was considered. The available methods for testing CO of lumped and distributed systems are outlined and various concepts were introduced. Much attention was devoted to the problem of optimally selecting actuator or sensor locations. Methods permitting analytical solutions were suggested and applied to examples. The accuracy of the eigenfunction expansion technique is discussed and a method for choosing the order of the lumped system to obtain a desired accuracy was developed. A general theory for the optimal control of multidimensional coupled distributed and lumped systems was developed using the maximum principle. Dissert. Abstr.

N78-29178 Massachusetts Univ., Amherst.
A SPECTROSCOPIC INVESTIGATION OF THE HYDROGEN-NITRIC OXIDE FLAME Ph.D. Thesis
Richard John Mainiero 1978 139 p
Avail: Univ. Microfilms Order No. 78-10735

Atmospheric pressure, premixed, flat H2-NO flames were stabilized on a 3.4 cm diameter Meker type burner. The cylindrical flame remained stable for a wide range of fuel compositions and remained uniform in diameter to a height of several

centimeters. Profiles of radiation emission and absorption were recorded for flames with five different H2-NO ratios: 1.5, 1.0, 0.82, 0.67, and 0.54. Flame temperatures and concentrations of OH, NO, and O were determined using spectroscopic methods. It appears that the three reactions involved in the decomposition of NO in the H2-NO flame; (1) H + NO yields N + OH; (2) NO + O yields N + O2; and (3) N + NO yields N2 + O. Dissert. Abstr.

N78-29179 Pittsburgh Univ., Pa.
ACTIVE SITES OF DEALUMINATED HYDROGEN MORDENITE Ph.D. Thesis
Kuldeep Narin Mathur 1977 200 p
Avail: Univ. Microfilms Order No. 7809965

Samples of hydrogen mordenite were extracted with hydrochloric acid at 100 C to remove aluminum. Leached hydrogen mordenite showed marked changes in the catalytic and adsorptive properties of the hydrogen mordenite. The surface acidity of hydrogen mordenite and dealuminated hydrogen mordenite catalysts was characterized by poisoning and irgrared spectroscopy. These acidity measures were compared with the observed cumene cracking activity. The activity measurements were conducted in a pulse micro-reactor at 250 C. The hydrogen mordenite catalysts were pretreated at temperatures between 400 and 700 C. The hydroxyl content of the samples were derived from infrared spectra taken from samples pretreated at identical temperatures. The pretreatment temperature of hydrogen mordenite samples was found to be very critical as it controls the acid characteristics of the catalyst and hence the catalytic activity. The maximum in catalytic activity occurred at a pretreatment temperature of 500 C. Dissert. Abstr.

N78-29180# British Library Lending Div., Boston Spa (England).
SOLUBILITY OF HYDROGEN CHLORIDE AND THE KINETICS OF DEGRADATION OF POLYVINYL CHLORIDE
R. A. Panko and V. S. Rudov 19 Dec. 1977 6 p refs Transl. into ENGLISH from Vysokomol. Soedin. (USSR), vol. 18, no. 11, 1976 p 864-866
(BLL-PO-Trans-3558-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The solubility coefficient of HCl in PVC and in samples of the polymer undergoing degradation were determined. HCl was obtained from the thermal degradation of brand M-64 PVC at 200 deg. The solubility of HCl in the polymer was determined with the aid of a monometer by measuring the reduction in the pressure of HCl in a vessel of capacity V sub o, containing g grams of the polymer. The solubility coefficient was determined from the ratio of concentration of HCl in the polymer and in the gas. If the pressure of HCl in the system is constant, the rate of evolution of HCl from PVC will, nevertheless, increase with time. When HCl is continuously pumped away, the rate of HCl formation reaches a stationary value, even when the input of catalytic reaction is very great, such as in thick PVC layers. A.R.H.

N78-29181 Texas Univ., Austin.
THE EFFECT OF SAMPLE ORIENTATION ON FLAME SPREAD ACROSS POLYURETHANE FOAMS Ph.D. Thesis
Richard Allan Schraufnagel 1977 317 p
Avail: Univ. Microfilms Order No. 78-07380

For a given material, the observed rate of flame spread could change by two orders of magnitude or more when the orientation between the flame and sample was changed. From a series of photographs, the flame propagation rate, length of flame, and angle between the flame and surface was determined. The radiant energy reaching the polymer was calculated for each orientation using view factors. The length of the ignition zone and radiant flux distribution along the surface can also be estimated from the view factor. From the calculated radiant heat flux and thermophysical properties of the solid phase, a theoretical flame spread rate was determined using the thermally thin flame propagation model. There was excellent agreement between the theoretical and measured flame spread rates for all foams at all the orientations studied. In additional experimental work, the effects of an external radiant heat source, as well as absorbed gases, on flame propagation were studied. Possible methods of extending the thermally thin model by predicting the flame size and orientation for a given sample configuration are also discussed. Dissert. Abstr.

N78-29182*# Oregon Univ. Health Sciences Center, Portland. Dept. of Neurology.
SPAR PROJECT: COUNTER CURRENT DISTRIBUTION OF BIOLOGICALS Final Report, 1 Dec. 1976 - 31 Dec. 1977
D. E. Brooks Dec. 1977 12 p ref
(Contract NAS8-32353)
(NASA-CR-150766) Avail: NTIS HC A02/MF A01 CSCL 07D

Preliminary ground based experiments strongly support the validity of a proposed space experiment in the separation of biological cells by counter current distribution (CCD). It was shown that a low level applied selective field can accelerate the separation of the phases by a very large factor. An electric field therefore should be very effective in space in lieu of gravity for the phase separation step. This appears to solve a central problem in implementing CCD in space and opens the technique to many types of large cell mixtures for which it has not been applicable before due to rapid settling effects. It was determined that electrophoretic migration of the cells, as a possibly disturbing factor, will be of negligible effect. Attenuation of a light beam by scattering generated a signal indicating the course of the phase separation. B.B.

N78-29183*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
ELECTROPHORETIC SEPARATOR FOR PURIFYING BIOLOGICALS, PART 1 Final Report
L. R. McCreight May 1978 61 p refs
(Contract NAS8-31036)
(NASA-CR-150768) Avail: NTIS HC A04/MF A01 CSCL 07D

A program to develop an engineering model of an electrophoretic separator for purifying biologicals is summarized. An extensive mathematical modeling study and numerous ground based tests were included. Focus was placed on developing an actual electrophoretic separator of the continuous flow type, configured and suitable for flight testing as a space processing applications rocket payload. B.B.

N78-29184# Purdue Univ., Lafayette, Ind.
FLAME EFFICIENCY, STABILIZATION AND PERFORMANCE IN PREVAPORIZING/PREMIXING COMBUSTORS Final Report, 1 Sep. 1975 - 30 Nov. 1977
S. L. Plee, D. A. Schmidt, and A. M. Mellor Dec. 1977 215 p refs
(Grant AF-AFOSR-2936-76)
(AD-A053635; PURDU-CL-77-07; AFOSR-78-0736TR) Avail: NTIS HC A10/MF A01 CSCL 20/2

Problems of combustion efficiency, incomplete prevaporization and flame stabilization (blowoff and/or flashback) associated with advanced prevaporizing/premixing turbojet combustors, afterburners and ramjet combustors are examined experimentally using a simplified axisymmetric burner. In addition to variations in combustor pressure, inlet temperature, equivalence ratio and air velocity typical of modern combustors, geometry and heterogeneous effects are also considered. Both flame stabilization and combustion efficiency data are examined using conventional and characteristic time correlations. Characteristic times, which have already been used to correlate and predict gaseous emissions in conventional combustors are quantified here for blowoff. The model is based on the flame stabilization theory of Zukoski and Marble and includes inlet, geometry and heterogeneous effects simultaneously, unlike traditional loading parameters. GRA

N78-29185# Purdue Univ., Lafayette, Ind.
SHOCK TUBE STUDIES OF FORMALDEHYDE PYROLYSIS
Anthony M. Dean, Brian L. Craig, Ron L. Johnson, M. Claire Schultz, and Edward E. Wang Apr. 1978 27 p refs Prepared by Missouri Univ., Columbia
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A053695; SQUID-UMO-3-PU) Avail: NTIS HC A03/MF A01 CSCL 21/2

Formaldehyde decay was followed by IR emission at 3.5 micrometers behind relfected shocks at total concentrations near 2.4 and 4.5 x 10 to the 18th power molecule/cc. Data

were obtained at 0.5 microsec intervals over a temperature range of 1700-2710 K for mixtures containing 0.1%, 0.5%, and 1.0% CH2O in Ar. Exponential decay was observed in all cases; at lower temperatures there was evidence of an induction time prior to the onset of the decay. An apparent rate was defined as k(a) = -(d(ln signal)/dt)/(M); k(a) was observed to be first order in argon and to decrease with increasing dilution. A reasonable fit to all the data, both in terms of temperature and concentration dependence, was obtained. Author (GRA)

N78-29186# Office of Naval Research, London (England).
INTERNATIONAL CONFERENCE ON MATRIX ISOLATION SPECTROSCOPY (1ST)
R. R. Smardzewski 22 Mar. 1978 5 p Conf. held at Berlin, 21-24 Jun. 1977
(AD-A053579; ONRL-C-7-78) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report discusses the content of several papers presented at the First International Conference on Matrix Isolation Spectroscopy. A brief discussion of the technique of matrix isolation spectroscopy is included. GRA

N78-29187# Brown Univ., Providence, R. I. Dept. of Chemistry.
SAMPLE MODULATED RAMAN SPECTROSCOPY AND FREQUENCY MODULATED VISIBLE LIGHT: RESONANCE RAMAN SPECTRUM OF A POLYDIACETYLENE FIBER
Costas T. Tzinis, Ray H. Baughman (Allied Chemical Co., Morristown, N. J.), Surinder K. Bahl, Paul Davidson, and William M. Risen, Jr. 20 Apr. 1978 26 p
(Contract N00014-75-C-0883)
(AD-A054674; TR-78-01) Avail: NTIS HC A03/MF A01 CSCL 20/6

Certain Raman-active vibrational modes of polydiacetylene fibers shift in frequency as they are stretched. Thus, the frequency of the Raman-scattered visible light itself shifts as the fiber sample is subjected to a tensile stress. In this work a fiber has been subjected to a periodic tensile stress, and the frequency of the Raman scattered light was found to be modulated at the frequency of this stress. GRA

N78-29188# Science Applications, Inc., San Diego, Calif.
MIXING AND COMBUSTION IN HIGH SPEED AIR FLOWS Interim Report, 1 Dec. 1976 - 31 Mar. 1978
R. B. Edelman Apr. 1978 47 p refs
(Contract F49620-77-C-0044)
(AD-A054398; SAI-78-008-WH; AFOSR-78-0878TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report describes the development of a modular model for the prediction of the performance of sudden expansion burners as a function of the controllable parameters relevant to combustors design. The model is based upon a concept in which the recirculation zone, treated as a stirred reactor, is coupled to a parabolic boundary layer formulation for the flow outside the recirculation zone. Hydrocarbon oxidation kinetics and turbulent kinetic energy models are employed in the model development. In addition to the parabolic-flow and stirred reactor elements, a module representing the fuel injection process has been developed. Results of the application of the modular model to the analysis of cold-flow and reacting-flow dump combustor experimental data are described. Author (GRA)

N78-29189# Wisconsin Univ., Madison. Mathematics Research Center.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. 3: PERTURBATIONS
J. D. Buckmaster and G. S. S. Ludford Jan. 1978 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A054538; MRC-TSR-1819) Avail: NTIS HC A02/MF A01 CSCL 21/2

Perturbations of a plane premixed flame propagating steadily along a uniform duct are considered. These may be caused by heat loss through the sides of the duct, for which conditions are steady, or by slight variations in the cross section, when a slowly varying flame results. Such unsteadiness may also be self-induced. The results, which concern quenching, stability and velocity changes as well as the behavior of an elementary burner, are remarkably sensitive to whether the Lewis number is greater or less than one. Author (GRA)

N78-29190# Wisconsin Univ., Madison. Mathematics Research Center.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. 2: THE PREMIXED PLANE FLAME
J. D. Buckmaster and G. S. S. Ludford Jan. 1978 23 p refs
(Contract DAAG29-75-C-0024)
(AD-A054537; MRC-TSR-1818) Avail: NTIS HC A02/MF A01 CSCL 21/2

An earlier paper (MRC TSR no. 1803) indicated that rational analysis of the governing equations of combustion can be based on activation-energy asymptotics. As an example, the basic problem of combustion theory is treated, namely the premixed plane flame (i.e. the unlimited one-dimensional steady solution). GRA

N78-29191# Los Alamos Scientific Lab., N. Mex.
ANION EXCHANGE OF 58 ELEMENTS IN HYDROBROMIC ACID AND IN HYDRIODIC ACID
S. F. Marsh, J. E. Alarid, C. F. Hammond, M. J. McLeod, F. R. Roensch, and J. E. Rein Feb. 1978 18 p refs
(Contract W-7405-eng-36)
(LA-7084) Avail: NTIS HC A02/MF A01

Anion exchange distributions of 58 elements were measured from 0.1-8.7M HBr and from 0.1-7.4M HI onto three strongbase resins, 8 and 4% cross linked and macroporous. Data were obtained by 16- to 18-h dynamic batch contacts. Anion exchange in these media was compared to that in HCl. The effect of resin cross linkage is considerably greater in HI media than in HBr and HCl media. Examples are presented of potentially useful separations using HBr and HI media alone in combination with HCl. ERA

N78-29192# Atomics International Div., Richland, Wash. Rockwell Hanford Operations.
DETERMINATION OF PARTICLE SIZE DISTRIBUTION OF SALT CRYSTALS IN AQUEOUS SLURRIES
Oct. 1977 45 p refs Presented at the 1978 Pittsburgh Conf. of the Soc. for Anal. Chemists of Pittsburgh and the Spectry. Soc. of Pittsburgh, Cleveland, Mar. 1978
(Contract EY-77-C-06-1030)
(RHO-SA-5; Conf-780217-1) Avail: NTIS HC A03/MF A01

A method for determining particle size distribution of water soluble crystals in aqueous slurries is described. The salt slurries, containing sodium salts of predominantly nitrate, but also nitrite, sulfate, phosphate, aluminates, carbonate, and hydroxide, occur in radioactive, concentrated chemical waste from the reprocessing of nuclear fuel elements. The method involves separating the crystals from the aqueous phase, drying them, and then dispersing the crystals in a nonaqueous medium based on nitroethane. Ultrasonic treatment is important in dispersing the sample into its fundamental crystals. The dispersed crystals are sieved into appropriate size ranges for counting with a HIAC brand particle counter. A preponderance of very fine particles in a slurry was found to increase the difficulty of effecting complete dispersion of the crystals because of the tendency to retain traces of aqueous mother liquor. Traces of moisture produce agglomerates of crystals, the extent of agglomeration being dependent on the amount of moisture present. ERA

N78-29193# National Physical Lab., Teddington (England). Div. of Chemical Standards.
VAPOUR-LIQUID EQUILIBRIUM DATA FOR BINARY SYSTEMS CONTAINING ALIPHATIC AMINES: DATA AND RECOMMENDATIONS
J. F. Counsell, J. H. Ellender, and C. P. Hicks Feb. 1978 185 p refs
(NPL-Chem-79) Avail: NTIS HC A09/MF A01

Available literature has been searched for VLE data on binary systems containing aliphatic amines. These data have been stored on a computer, analyzed where possible for consistency, and this analysis used as a basis for comments on their reliability. These comments are compiled for each data set considered and a selection of data sets is presented which, for a particular system, are either those thought to be more reliable for a

temperature range or which contain the only data available.
Author (ESA)

N78-29194# National Physical Lab., Teddington (England). Div. of Chemical Standards.
VAPOUR-LIQUID EQUILIBRIUM DATA FOR BINARY SYSTEMS CONTAINING ALIPHATIC AMINES: FITTING AND CORRELATION
C. P. Hicks and J. F. Counsell Feb. 1978 52 p refs
(NPL-Chem-80) Avail: NTIS HC A04/MF A01

Selected vapor-liquid equilibrium data for binary amine systems were fitted to a number of common correlating equations. Fitted coefficients are given and the conclusions which may be drawn from the fits are outlined. The UNIFAC group contribution theory was used to correlate the available data so that activity coefficients can be predicted for related systems. Problems encountered in the use of the UNIFAC theory are discussed. Predicted activity coefficients at infinite dilution are tabulated for 275 binary mixtures. The information necessary to reproduce these data and to extend the calculations to other binary and multicomponent systems is given. Author (ESA)

N78-29195# National Physical Lab., Teddington (England). Div. of Chemical Standards.
A METHOD FOR THE ESTIMATION OF THE CRITICAL TEMPERATURES OF ALKANOLS
I. J. Lawrenson Mar. 1978 8 p refs
(NPL-Chem-81) Avail: NTIS HC A02/MF A01

The estimation of the critical temperatures of alkanols, both linear and branched, is discussed. For this class of compounds, the Lydersen method does not give good agreement with experimental values for molecules larger than n-propanol. Selected values of Tc for normal alkanols up to C sub 10 are shown in tabular form together with values calculated by the Lydersen method. A similar comparison for branched alkanols shows even worse agreement. An estimation method should be capable of providing a value of the critical temperature good to within 5 K; this uncertainty will in general result in an uncertainty of less than 0.01 in reduced temperature as used in a corresponding states estimation method. Author (ESA)

N78-29196# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Physikalische Chemie der Verbrennung.
MEASUREMENT OF SMALL CONCENTRATIONS OF POLLUTANTS IN GASES BY AN OPTICAL AC WAVE-LENGTH SCANNING METHOD
S. Kelm and H. Eberius Jan. 1978 104 p refs In GERMAN; ENGLISH summary Sponsored in part by Deut. Forschungsgemeinschaft Report will also be announced as translation (ESA-TT-489)
(DLR-IB-453-78/1) Avail: NTIS HC A06/MF A01

An optical scanning method, based on absorption derivative spectroscopy, is described by which very small concentrations of pollutants, e.g., NO, NH3 in gases, can be measured. Under different experimental conditions the theoretical and practical limits of the method were determined by an extensive analysis of different noise sources. Characteristic quantities for the optimization of the method are presented. The optical scanning method was applied for the analysis of combustion gases of hydrocarbonair flames. Author (ESA)

N78-29197# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
DEHYDRATING MAGNESIUM CHLORIDE BY DOUBLE SALT-SALT DECOMPOSITION
Joan T. May, Vern E. Edlund, and Don C. Seidel 1978 25 p refs
(PB-279653/0; BM-RI-8277) Avail: NTIS HC A02/MF A01 CSCL 07D

Laboratory-scale dehydration tests were made with 35 percent magnesium chloride brine and with spray-dried magnesium chloride mixed with anline or pyridine hydrochloride in an amount in excess of that required to form the hydrated equimolar double salt. The mixture was heated to produce an anhydrous double salt. This was decomposed to anhydrous magnesium chloride and volatile organic amine hydrochlroide which was collected for recycle. The organic amine hydrochloride chlorinated magnesium oxides that were present in present spray-dried magnesium chloride and freed the amine which was collected and converted to the amine hydrochloride by addition of hydrochloric acid. This chlorination reaction occurred at 375 C. The anhydrous magnesium chloride products obtained by this process contained less than 0.8 percent oxygen. GRA

N78-29198# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
METHANATION ACTIVITY OF RANEY NICKEL CATALYSTS: EFFECT OF PROPORTION OF NiAl3 AND Ni2Al3 IN PRECURSOR ALLOYS Technical Report, 6 Jul. 1976 - 7 Jul. 1977
Laurance L. Oden and James H. Russell 1978 21 p refs Prepared in cooperation with ERDA
(PB-279656/3; BM-RI-8272) Avail: NTIS HC A02/MF A01 CSCL 07D

The Bureau of Mines is developing Raney nickel catalysts for converting synthesis gas derived from coal to synthetic natural gas. The relationship between the composition of Raney nickel alloys in the range NiAl3 to Ni2Al3 equilibrated at 840 C and the properties of catalysts is described. Methanation activity was determined in the temperature range of 300 to 360 C in a flowing gas stream containing 1 pct CO, 8 pct H2 and the remainder He. One ppm H2S was added to the gas stream at 400 C to evaluate the susceptibility of catalysts to sulfur poisoning. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-29199 Illinois Univ. at Urbana-Champaign, Urbana.
LIQUID METALS AS PROCESS SOLVENTS: DESIGN TECHNIQUES FOR MAGNESIUM OXIDE REDUCTION Ph.D. Thesis
Charles Wilbur Graves 1978 195 p
Avail: Univ. Microfilms Order No. 7811244

Through the application of recently developed liquid metal technology, a method for designing industrial processes for producing metals from their oxide ores with significant savings of the energy consumed by existing methods was developed. In order to demonstrate the feasibility of the metal-solvated process, the carbothermic reduction of magnesium oxide in the presence of several different solvent metals was studied. Experimental verification that the equilibrium concentration of the metal could be increased by a factor corresponding to the decrease in the activity coefficient of the metal due to intermetallic compound formation was obtained. Equally important was the determination that distillation could be used to separate the product and solvent metals. Dissert. Abstr.

N78-29200 Cornell Univ., Ithaca, N. Y.
MORPHOLOGY OF VICINAL SURFACES OF NICKEL AND EQUILIBRIUM SEGREGATION OF CARBON TO Ni(111) Ph.D. Thesis
Hira V. Thapliyal 1978 147 p
Avail: Univ. Microfilms Order No. 7809526

The higher Miller index surfaces of single crystal nickel in the vicinity of the (111) plane were studied using low energy electron diffraction and Auger electron spectroscopy. A nomenclature was proposed to designate a vicinal surface of a single crystal material M in the form M(xyz) alpha (abc). The surface is the (abc) zone at an angle alpha from a nearby low Miller index plane (xyz). Clean, carbon covered, and sulfur covered surfaces were examined at various temperatures. The equilibrium segregation of carbon to Ni(111) was studied for a specimen which was doped with carbon to give a precipitation temperature of 900 C. The graphite monolayer phase' of carbon on Ni(111) segregated at 1015 C and the bulk precipitation was observed at 890 C. Using this data the assumption of entropy equivalence between the 'monolayer phase' and bulk graphite was shown to be valid. Dissert. Abstr.

N78-29201 Cornell Univ., Ithaca, N. Y.
THEORETICAL AND EXPERIMENTAL STUDIES OF REACTIVITY AND BONDING OF TRANSITION-METAL ORGANOMETALLIC COMPOUNDS Ph.D. Thesis
David Lincoln Thorn 1978 298 p
Avail: Univ. Microfilms Order No. 7809527

Reactivity, bonding, and structure in transition metal organometallic chemistry were investigated. The mechanism of olefin insertion reaction in platinum-hydride compounds, the electronic structure of complexes containing the M2(CO)6 binuclear transition metal fragment bonded to a variety of ligands, and the reactivities of binuclear transition metal acetylene complexes were specifically studied. The electronic factors which determine the coordination mode of diatomic ligands to transition metals are discussed. A Walsh diagram is constructed for the progression of a linearly bonded diatomic molecule through bent, kinked conformations to a dihapto, side-on bonded structure. This molecular orbital picture permits understanding of the effects of d-electron configuration and substituents on the metal on the preferred coordination of the diatomic molecule. Dissert. Abstr.

N78-29202 Pittsburgh Univ., Pa.
DYNAMIC STRAIN AGING BEHAVIOR AND ITS IMPACT ON TENSILE AND CREEP DEFORMATION OF Ti-5Al-2.5Sn Ph.D. Thesis
Ashok Kumar Mehrotra 1977 204 p
Avail: Univ. Microfilms Order No. 78-09966

The microscopic plastic deformation behavior was studied along with dislocation mechanisms of dynamic strain aging in commercial purity Ti-5Al-2.5Sn, a single phase alpha titanium alloy. The temperature range of 77-900 K was scanned using constant strain rate tensile tests, strain rate cycling tensile tests, constant load creep tests to very low creep strain levels and dislocation substructure observations using transmission electron microscopy. Dislocation arrangements, in the form of planar arrays, networks, subboundaries and other configurations, were followed from low to high temperatures. Dynamic strain aging has been shown to occur in the alloy in the form of increased work hardening rates, very low strain rate sensitivity and blue bittleness (in the temperature interval of 600-800 K in uniaxial testing at a strain rate of 0.033/sec). This behavior is similar to the behavior of commercially pure Ti except a broader peak and corresponding broader valley is observed in work hardening rate and strain rate sensitivity with temperature. Dissert. Abstr.

N78-29203 California Univ., Los Angeles.
HIGH TEMPERATURE IRRADIATION DAMAGE IN NICKEL-CHROMIUM SOLID SOLUTIONS Ph.D. Thesis
Russell F. Pinizzotto, Jr. 1978 226 p
Avail: Univ. Microfilms Order No. 7811377

Pure Ni and Ni-Cr solid solutions containing up to 16% Cr were irradiated using heavy charged particles to simulate the radiation damage caused by neutron bombardment. Samples were irradiated between 500 and 700 C, which corresponds to 0.4 to 0.6 of the melting points of these materials. The specimens were exposed to a maximum damage level of 20 dpa. The irradiation induced microstructures were characterized using standard transmission electron microscopy techniques. The main components of the microstructures are a great number of voids that cause macroscopic volume increases and a dislocation distribution consisting of perfect dislocations and faulted dislocation loops. The variations of the microstructural parameters were examined as functions of the Cr content, the irradiation temperature, the total irradiation temperature, the total irradiation dose, the type of incident ion and the sample configuration.
Dissert. Abstr.

N78-29204 Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTRICAL PROPERTIES AND STRUCTURE OF BaO-B2O3-SiO2 GLASS CONTAINING TITANIUM IONS Ph.D. Thesis
Bharat Singh Rawal 1977 174 p
Avail: Univ. Microfilms Order No. 7802861

The ac and dc conductivities, complex dielectric constants and optical absorption phenomena were investigated in BaO-B2O3-SiO2 glass containing 0 to 12 mole% titanium ions between room temperature and 800 K. Valence concentration ratio was varied at each concentration between the range 0.15 to 0.85. The conductivities were found to increase with increasing Ti(3+) and increasing total Ti ion concentrations. The dc and ac conductivities show a break around the critical composition between 4 and 6 mole% total titanium above which they increased very rapidly. Titanium ions are distributed in clusters and can be alternatively thought of as linear chains of M-O-M structures connected at various points. The characteristic chain lengths are found to be 6 to 9 atoms long. Dissert. Abstr.

N78-29205 Florida Univ., Gainesville.
OXYGEN AND NITROGEN DIFFUSION IN GROUP V TRANSITION METALS Ph.D. Thesis
Francisco Jose Martins Boratto 1977 172 p
Avail: Univ. Microfilms Order No. 78-10925

Mechanical relaxation tests (low frequency internal friction and elastic after-effect) were performed in vanadium, niobium and tantalum, the Group 5 transition metals, using a torsion pendulum equipped with LVDT transducers connected to an oscillograph for automatic data recording. The internal friction and elastic after-effect curves were analyzed by a nonlinear least square relaxation times for the diffusion of oxygen and nitrogen in the above metals. This analysis yielded diffusion coefficients to temperatures as low as 23 C. The new low temperature data were combined with high temperature direct values and intermediate temperature high frequency internal friction results reported in the literature. Experimental energy of activation, frequency factor and entropy of activation values were compared with Zener's and Keyes' theoretical values. Oxygen contamination in vacuum was observed in all three transition metals. Dissert. Abstr.

N78-29206 Florida Univ., Gainesville.
STRUCTURAL EVOLUTION AND ELECTRICAL CONDUCTIVITY OF SINTERED URANIUM DIOXIDE Ph.D. Thesis
Stephan Mark Gehl 1977 256 p
Avail: Univ. Microfilms Order No. 78-10949

The simple counting measurements of quantitative stereology were used to determine the sequences of microstructural states attained during conventional sintering and hot pressing of uranium dioxide powders. Each such sequence, called a path of microstructural change, was evaluated by measuring, for a series of specimens, the pore volume fraction; the area, total curvature, and gross tangent count of the pore-solid interface; the grain-boundary area; and the lengths of the triple lines formed by the intersection of the grain boundaries with each other, and with the pore-solid interface. Electrical conductivity measurements were performed on a series of conventionally sintered specimens. The results of these experiments were compared with the quantitative stereology measurements to determine the effect of microstructure on electrical conductivity. Dissert. Abstr.

N78-29207 Florida Univ., Gainesville.
PACKING, SINTERING AND BLENDING OF BINARY POWDER MIXTURES Ph.D. Thesis
Gary Lynn Messing 1977 132 p
Avail: Univ. Microfilms Order No. 7810974

Mathematical procedures are presented to permit the assessment of the contribution of compositional inhomogeneities for particle packing and sintering. Also, a fundamental evaluation of vibratory blending was given from which meaningful methods of reducing inhomogeneities can be developed. For the packing of binary powder mixtures a theoretical methodology was developed which makes possible the calculation of the specific volume of an inhomogeneous mixture. The procedure is based on the hypothesis that the Furnas model is valid on a local level. Using two hypothetical examples it was demonstrated that the specific volume composition curves calculated by the methodology have shapes resembling typical experimental data. To test the hypothesis, inhomogeneous binary powder mixtures of glass microbeads were sampled and the compositional inhomogeneity data used to calculate the specific volume.
Dissert. Abstr.

N78-29208 Minnesota Univ., Minneapolis.
ELECTRON MICROSCOPY OF CRYSTALLINE AND AMORPHOUS ELECTRODEPOSITED THIN Ni-P FILMS Ph.D. Thesis
Enayatollah Enayat Vafaei-Makhsoos 1977 205 p

Avail: Univ. Microfilms Order No. 7809760

Electrodeposited Ni-P alloys are interesting because they are metallic, ferromagnetic, and at certain compositions, they are amorphous. While the magnetic properties and the structure of the amorphous state were studied extensively, there never was a detailed electron microscopy study of this system. The structure is known to depend upon composition, deposition, and annealing conditions. Two types of dendritic morphology were observed, a low angle branching dendritic morphology with the Ni12P5 crystal structure and a high angle branching dendritic morphology. The high angle branching dendritic arms revealed the presence of two overlapping crystals; a uniform crystal and a twin platelet crystal which was heavily faulted. Dissert. Abstr.

N78-29209 British Library Lending Div., Boston Spa (England).
ADHESION OF ELECTROLYTIC ZINC TO ALUMINUM CATHODES
R. Kammel and H. Saadat Jan. 1978 17 p refs Transl. into ENGLISH from Metall (West Germany), no. 6, 1976 p 551-555
(BLL-RTS-10973) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Strong adhesion of precipitated zinc on the aluminium cathode was observed in the commercial production of zinc by means of electrolysis. Laboratory investigations showed that the adhesion values could be about 150-250 N/sq cm. Chlorine and fluorine ions in the electrolyte, and high bath temperatures increased the intensity of the retention. J.A.M.

N78-29210# British Library Lending Div., Boston Spa (England).
ADHESION OF GOLD IN ULTRA-HIGH VACUUM
Koichi Fujiwara 19 Dec. 1977 22 p refs Transl. into ENGLISH from Junkatsu, J. Jap. Soc. Lubrication Engr. (Japan), vol. 22, no. 1, 1977 p 37-44
(BLL-PO-Trans-3555-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The influence of surface films, tangential displacement, repeated contact and specimen temperature on the adhesion of gold was studied with reference to clean metal surface created under ultra-high vacuum conditions. B.B.

N78-29211 Brown Univ., Providence, R. I.
THE HARDNESS AND DEFORMATION OF TUNGSTEN CARBIDE-COBALT ALLOYS Ph.D. Thesis
Hu-Chul Lee 1977 132 p
Avail: Univ. Microfilms Order No. 78-09072

An attempt was made to relate mechanical properties, such as hardness and Young's modulus, of cemented tungsten carbide to the microstructure of the alloys by combining the concepts of dispersion hardening and carbide skeleton deformation. The structure of WC-Co alloys was studied. The particle size, binder mean free path and contiguity were obtained by linear analysis of electron photomicrographs. It was shown that the carbide particles form a continuous carbide skeleton through direct carbide-carbide contacts. The degree of continuity was discussed in terms of contiguity. The volume fraction of this continuous carbide skeleton was calculated to be equal to the volume fraction of the carbide phase multiplied by the contiguity of that phase. Dissert. Abstr.

N78-29212 Maryland Univ., College Park.
ELECTRONIC STRUCTURE OF EQUIATOMIC ALLOYS OF ALUMINUM WITH IRON, COBALT AND NICKEL Ph.D. Thesis
David Joseph Nagel 1977 332 p
Avail: Univ. Microfilms Order No. 7808185

The CsCl structure intermetallic alloys AlFe, AlCo and AlNi have exceptionally wide (beta phase) ranges of stability. For this and other reasons, they have been the subject of numerous theoretical and experimental studies. Full electronic structure of the equiatomic materials was studied. Many aspects of bonding in these materials were computed. X-ray and electron spectra were both calculated and measured. The augmented plane wave method was used with the Slater X alpha exchange approximation to compute the self-consistent energy bands, Bloch wave functions, charge distributions, densities of states (total and component) and Fermi surfaces. The total density of states curves show that a molecular-orbital model for these materials incorrectly reversed the energies of the d-electron levels. Dissert. Abstr.

N78-29213 Cornell Univ., Ithaca, N. Y.
DIRECT OBSERVATION OF THE POINT-DEFECT STRUCTURE OF DEPLETED-ZONES IN ION-IRRADIATED METALS Ph.D. Thesis
Ching-Yeu Wei 1978 274 p
Avail: Univ. Microfilms Order No. 7809319

The point-defect structure of individual depleted zones was studied. Four-pass zone-refined tungsten field-ion microscope (FIM) specimens were irradiated in-situ at 10 K with 30 keV Cr(+), Mo(+) or W(+) ions and examined by the pulse field-evaporation technique at 10 K. The experimental conditions were arranged such that each depleted zone was created by a single incident-ion. The number of vacant lattice sites within a depleted zone was compared with a modified Kinchin-Pease model. The radial distribution function was determined for each depleted zone; it was found that the vacant lattice sites within the volume of each depleted zone tended to exist in a highly clustered state. The spatial distribution of self-interstitial atoms (SIAs) in a specimen irradiated with 30 keV Cr(+) ions and in a specimen irradiated with 18 keV Au(+) ions, at 10 K, was determined. Dissert. Abstr.

N78-29214*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION OF A BIMETALLIC INTERFACE Ph.D. Thesis - Case Western Reserve Univ.
John Ferrante Jun. 1978 332 p refs
(NASA-TM-78890) Avail: NTIS HC A15/MF A01 CSCL 11A

The Hohenberg-Kohn and Kohn-Sham formalisms are used to examine binding (binding energy as a function of separation) for combinations of the simple metals Al(111), Zn(0001), Mg(0001), and Na(110) in contact. Similar metal contacts between Al, Zn, Mg, and Na are examined self-consistently in an ab initio calculation using the Kohn-Sham formalism. Crystallinity is included using the Aschroft pseudopotential via first order perturbation theory for the electron-ion interaction; and the ion-ion interaction is included exactly via a lattice sum. Binding energy was determined both in the local-density approximation and including gradient corrections to the exchange and correlation energy. Binding was found in all cases. In dissimilar metal contacts, interfacial bonding was greater than that in the weaker material predicting the possibility of metallic transfer. The nonzero position of the energy minimum in like metal contacts is explained in terms of consistency between the Ashcroft pseudopotential and the bulk charge density. Good agreement with experimental surface energies is obtained in the self-consistent calculation when nonlocal terms are included. Author

N78-29215*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RUB TOLERANCE EVALUATION OF TWO SINTERED NiCrAl GAS PATH SEAL MATERIALS
Robert C. Bill Jul. 1978 12 p
(NASA-TM-78967; AVRADCOM-TR-78-39(PL); E-9726) Avail: NTIS HC A02/MF A01 CSCL 11F

Two strength level variations of sintered NiCrAl (about 40 percent dense), candidate high pressure turbine seal materials, were subject to rub tolerance testing against AM 355 steel blade tips. The high strength material (17 N/sq mm tensile strength) showed frictional and radial loads that were 20 to 50 percent higher than those measured for the low strength material (15.5 N/ sq mm tensile strength). Measured wear to the AM 355 blade tips was not significantly different for the two sintered NiCrAl seal materials. Wear of the sintered NiCrAl was characterized by material removal to a depth greater than the depth to which blade tips were driven into the seal, indicating self-erosion effects. Author

N78-29216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTIONS OF YTTRIA-STABILIZED ZIRCONIA WITH OXIDES AND SULFATES OF VARIOUS ELEMENTS Final Report
Isidor Zaplatynsky Jul. 1978 16 p refs

(Contract EF-77-A-01-2593)
(NASA-TM-78942; DOE/NASA/2593-78/1; E-9689) Avail: NTIS HC A02/MF A01 CSCL 11B

The reactions between partially stabilized zirconia, containing 8 weight-percent yttria, and oxides and sulfates of various elements were studied at 1200, 1300, and 1400 C for times to 800, 400, and 200 hours, respectively. These oxides and sulfates represent impurities and additives potentially present in gas turbine fuels or impurities in the turbine combustion air as well as the elements of the substrate alloys in contact with zirconia. Based on the results, these compounds can be classified in four groups: (1) compounds which did not react with zirconia (Na_2SO_4, K_2SO_4, Cr_2O_3, Al_2O_3 and NiO); (2) compounds that reached completely with both zirconia phases (CaO, BaO, and $BaSO_4$); (3) compounds that reacted preferentially with monoclinic zirconia (Na_2O, K_2O, CoO, Fe_2O_3, MgO, SiO_2, and ZnO); and (4) compounds that reacted preferentially with cubic zirconia (V_2O_5, P_2O_5). Author

N78-29217*# Stanford Univ., Calif. Dept. of Material Science and Engineering.
CREEP OF OXIDE DISPERSION STRENGTHENED MATERIALS (WITH SPECIAL REFERENCE TO TD NICHROME) Final Report
Jerhong Lin and Oleg D. Sherby Jun. 1978 61 p refs
(Grant NGR-05-020-671)
(NASA-CR-135432) Avail: NTIS HC A04/MF A01 CSCL 11F

It was shown that the creep behavior of oxide dispersion strengthened (ODS) alloys is controlled principally by the creep properties of the matrix of the alloy devoid of particles. Thus, diffusion controlled slip process determine the rate controlling step in such materials. The role of the particles is to stabilize a fine substructure which is invariant with the creep stress over a wide range of stress. This characteristic leads to negligible strain hardening during creep and suggests that creep relations developed for pure metals and many solid solution alloys at constant structure should be used to describe the creep of ODS alloys. A second characteristics of the ODS alloys is that a stress may exist below which creep will not occur (threshold stress). B.B.

N78-29218# Royal Aircraft Establishment, Farnborough (England).
EXAMINATION OF THE MECHANICAL PROPERTIES OF PRODUCTS OF TITANIUM ALLOYS OBTAINED BY AN ORIGINAL HOT-WORKING TECHNIQUE
B. DeGelas, M. Armand, and R. Tricot Mar. 1978 24 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (France), Jan. 1977 24 p
(RAE-Lib-Trans-1969; BR63693) Avail: NTIS HC A02/MF A01

Products made from titanium alloys can be hot-worked in the beta field using a technique which is rapid in operation and which suppresses or minimizes the unfavorable effect of the recrystallization of the beta grains. The products obtained by forging are characterised by their macro- and microstructures, and also by their mechanical properties such as tensile strength, toughness and fatigue strength. Finishing stage processing constraints restrict the technological principles which can be considered to rolling (bars, sheet metal, wires) or to extrusion (profiles), and excludes classical forging except in special cases (small pieces). A.R.H.

N78-29219# Battelle Columbus Labs., Ohio.
INVESTIGATING LOCALIZED CORROSION AND SPUTTERING FEASIBILITY OF AMORPHOUS CHROMIUM-CONTAINING ALLOYS Interim Technical Report, 1 May 1977 - 30 Apr. 1978
R. B. Diegle, D. M. Lineman, and W. K. Boyd Apr. 1978 50 p refs
(Contract N00014-77-C-0488)
(AD-A053581) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report summarizes progress in understanding the nature of localized corrosion of amorphous Fe-Ni-Cr-P-B alloys, and in developing a technique to sputter deposit these alloys. Although Cr improves their resistance to crevice and crevice attack, it is not necessary: 0 at. percent Cr melt spun alloys exhibited resistance to localized corrosion which was greatly superior to that of T304 stainless steel. Although the alloys can be made to crevice corrode, their resistance to this form of attack appears to exceed that of many crystalline stainless steels. A deposit was produced by sputtering and shown to possess corrosion resistance nearly as great as the melt spun alloys. Author (GRA)

N78-29220# Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.
THE EFFECTS OF MICROSTRUCTURAL FEATURES ON THE RESPONSE OF ALUMINUM ALLOYS TO CYCLIC DEFORMATION Final Technical Report, 1 Jan. 1974 - 31 Dec. 1977
Edgar A. Starke, Jr. Feb. 1978 16 p
(Grant AF-AFOSR-2615-74)
(AD-A053649; AFOSR-78-0731TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

This program has been designed to isolate and determine the various parameters which control the mechanical behavior during monotonic and cyclic loading of alloys containing various microstructural features developed during the decomposition of 7XXX type aluminum alloys. In addition, limited studies of the stress-corrosion resistance and corrosion-fatigue resistance has been made. The primary goal has been to understand the fundamentals of the deformation processes involved in monotonic and cyclic loading. The results obtained from this study should lead to improvements in the properties of existing alloy systems through control of the microstructure and suggest ways of developing fatigue resistant age-hardenable aluminum alloys. Author (GRA)

N78-29221# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
CORROSION FATIGUE OF HIGH STRENGTH AIRCRAFT STRUCTURAL MATERIALS - CRYSTALLOGRAPHIC DEPENDENCE OF FRACTURE PATH IN Al-Zn-Mg (7075) ALLOYS Final Technical Report, 1 Jul. 1972 - 30 Sep. 1974
R. E. Stoltz and R. M. Pelloux Dec. 1977 18 p refs
(Contract F33615-72-C-1288)
(AD-A053743; AFML-TR-77-36) Avail: NTIS HC A02/MF A01 CSCL 11/6

Low cycle corrosion fatigue tests were conducted in a variety of environments to quantitatively demonstrate the environmental effects on high strength aluminum (7075-T6) alloys. Environments used included argon, dry air, distilled water, and 3.5% sodium chloride solution. Crack growth rates were found to vary by almost two orders of magnitude, from .0001 to .000001 inches per cycle, with argon and dry air the lowest and sodium chloride solution the highest. Scanning electron micrographs clearly showed the transition from ductile to brittle failure going from inert to aggressive environments. Author (GRA)

N78-29222# Pennsylvania State Univ., University Park. Applied Research Lab.
HOT CORROSION AND OXIDATION STUDIES ON COBALT-BASED ALLOYS M.S. Thesis
Vincent F. Hock, Jr. 13 Jul. 1977 162 p refs
(Contract N00017-73-C-1418)
(AD-A053745; ARL/PSU-TM-77-274) Avail: NTIS HC A08/MF A01 CSCL 11/6

The rates of oxidation and hot corrosion of pure cobalt, cobalt-chromium, cobalt-silicon and cobalt-chromium-silicon alloys were determined at 1000 C in oxygen at a pressure of 0.1 atmosphere. The hot corrosion studies were conducted under conditions of a continous supply of Na_2SO_4 to the sample surface. In addition, the effect of thermal cycling on the hot corrosion resistance of the Co-15 Cr-Si alloy group was also investigated. For the cobalt-chromium alloys, it was found that a considerable decrease in the oxidation and hot corrosion rates occurred at chromium concentrations about 15 wt.%. The cobalt-silicon binary alloys showed a dramatic increase in the rate of oxidation up to 0.05 wt.% silicon according to normal doping theory. At silicon concentrations greater than 5 wt.%, a marked decrease in oxidation and hot corrosion was observed. Generally, the series of cobalt-chromium-silicon alloys exhibited much better oxidation and hot corrosion resistance than the binary alloys. The lowest rates were obtained for alloys with high silicon contents. One alloy in particular, Co-10 Cr-10 Si, exhibited the lowest total

weight gain per unit area for both oxidation and hot corrosion. The hot corrosion resistances of the Co-15 Cr-Si alloys were decreased by thermal cycling. Author (GRA)

N78-29223# Ktech Corp., Albuquerque, N. Mex.
MEASUREMENT OF ISOCHORIC PRESSURE-ENERGY FOR POROUS MATERIALS, PART 1. STRESS-MATCHING TECHNIQUE AND REFERENCE MATERIAL RESULTS Final Report, Oct. 1975 - Nov. 1976
N. H. Froula 30 Nov. 1976 57 p refs
(AD-A054329; AD-E300113; KTECH-TR-76-11-1; DNA-4187F-1) Avail: NTIS HC A04/MF A01, CSCL 11/6

For several years pulsed electron beam machines have been used to rapidly deposit energy in sample materials, and various techniques have been employed to infer the resulting constant volume heating pressure-energy (P-E) relation. In Part I, a new electron beam stress-matching technique is described which provides a more direct measurement of both P and E through the utilization of reference materials having known P-E relations. The P-E characteristics of aluminum (6061-T6), germanium (111), quartz (X-cut), and silicon (polycrystal were measured to 100 cal/g and are presented in Part I. The results of the application of this technique to determine the Gruneisen parameters of four porous materials is given in Part II. Author (GRA)

N78-29224# Naval Surface Weapons Center, White Oak, Md.
THIN FILM CORROSION OF ANODIZED HIGH-STRENGTH ALUMINUM ALLOYS Interim Report
H. M. DeJarnette and C. R. Crowe 23 Feb. 1978 28 p refs
(AD-A054424; NSWC/WOL/TR-78-29) Avail: NTIS HC A03/MF A01 CSCL 11/6

Progress is reported in the development of a procedure for measuring the susceptibility of alloys to marine atmospheric corrosion. The availability of a variety of aluminum alloys, tempers, and protection methods necessitates a test method which is rapid, reproducible, quantitative, and representative of the atmosphere corrosion experienced by Naval components. A testing apparatus is herein described as are the specimen preparation techniques, test environment, and data reduction method. The corrosion cell is designed to subject the specimen both to a thin, salty film of moisture and to a controlled electrical potential. The resulting current through the specimen is recorded as a function of this potential and as a function of time. To minimize the effects of random variations, both the order in which tests are run and specimen selection are randomized. Preliminary times-to-failure from aluminum alloy 7075-T73 specimens with sulfuric acid anodizing, with sulfuric acid anodizing plus sealing, and with chromic acid anodizing, corroborate the validity of the procedure. As some specimens survived more than 200 hours before onset of pitting corrosion, planned methods for shortening the test are given. Author (GRA)

N78-29225# California Univ., Livermore. Lawrence Livermore Lab.
SOFT-SPHERE MODEL FOR LIQUID METALS
D. A. Young 8 Nov. 1977 19 p refs
(Contract W-7405-eng-48)
(UCRL-52352) Avail: NTIS HC A02/MF A01

A semi-empirical, soft sphere model of fluids was modified for application to the thermodynamic properties of liquid metals. Enthalpy, volume and sound speed were computed as functions of temperature for 13 metals and compared with experimental data. Critical points and coexistence curves were also computed and compared with experimental data, where these were measured. Strengths and weaknesses of the model are discussed. ERA

N78-29226# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
COMPARISON OF THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF 300-M STEEL MANUFACTURED BY THE VACUUM ARC REMELT AND THE ELECTROSLAG REMELT PROCESSES
Thomas A. Lechtenberg Sep. 1977 47 p refs
(Contract W-7405-eng-48)
(LBL-6686) Avail: NTIS HC A03/MF A01

The transverse (T-L) and longitudinal (L-T) mechanical properties of electroslag refined (ESR) and vacuum arc remelt (VAR) 300-M steel were measured. These were related to the microstructural and chemical differences which resulted from the two melting processes. It was found that the ESR process resulted in a cleaner steel. Impurity elements were reduced and inclusions were finer and more evenly dispersed. The Charpy impact energies of the ESR steel were nearly doubled those of the VAR. Also the fracture toughness of the ESR 300-M showed no temper embrittlement in the 350 to 500 C tempering range whereas that of the VAR material did. ERA

N78-29227# McElroy (Ralph) Co., Austin, Tex.
ANALYZING X-RAY VALENCE BAND SPECTRA BY MATHEMATICAL METHODS. DISCUSSION AND INVESTIGATION OF NOISE REDUCTION, DIFFERENTIATION AND DECONVOLUTION OF SPECTRA
Helmut Drack and Manfred Rasserbawer Jan. 1978 18 p refs Transl. into ENGLISH from Michrochim. Acta, Suppl. (Vienna), v. 7, 1977 p 289-302 Presented at the 8th Colloq. on Metallographic Analysis with Spec. Emphasis on Electron and Ion Beam Microanalysis, Vienna, 27-29 Oct. 1976 Sponsored by DOE Prepared for Calif. Univ., LLL
(UCRL-Trans-11326; Conf-7610144-1) Avail: NTIS HC A02/MF A01

A mathematical treatment is presented for X-ray valence band spectra to enchance the fine structure in order to improve the possibilities of the direct identification of compounds by use of the spectral features. The mathematical procedures include smoothing, differentiation, and unfolding of valence band spectra. For smoothing and differentiation, the procedures developed by Savitzky and Golay and for unfolding the Fourier transformation are used. The effect of these mathematical steps on the spectral fine features is shown for the Cu-L-spectra of Cu, Cu2O and CuO which originally have only a slightly different structure. ERA

N78-29228# Research Inst. of National Defence, Stockholm (Sweden).
METHODS FOR THE DETERMINATION OF GASES IN METALS
Knut-Fredrik Alm May 1976 14 p refs
(FOA-B-20009-D4(F3); ISBN-91-7056-042-0) Avail: NTIS HC A02/MF A01; Res. Inst. of Natl. Defence, Stockholm Sw.Kr. 4

Methods for the determination of gaseous hydrogen, nitrogen, and oxygen in metals were surveyed. Conventional methods for the determination of gases in metals in particular in samples containing very small amounts of gas, were evaluated. A levitation technique for the determination of gases in very small samples or in samples with very low gas content was developed and evaluated. ESA

N78-29229# National Technical Information Service, Springfield, Va.
PIPELINE CORROSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1978
Mona F. Smith May 1978 140 p
(NTIS/PS-78/0453/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Federally-sponsored research on pipeline corrosion in soils, sea water and fresh water are covered. Studies include pipeline systems containing natural gas, petroleum, slurries, water, and volatile or corrosive liquids. Materials for pipelines are discussed as well as inhibitors for pipeline systems. Coatings, linings, welding, and testing are described as they relate to corrosion, (134 abstracts). GRA

N78-29230# National Technical Information Service, Springfield, Va.
PIPELINE CORROSION, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - 1976
Mona F. Smith May 1978 180 p
(NTIS/PS-78/0454/5-Vol-1) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Citations from worldwide journals are presented on defects and hazards caused by corrosion. Studies on pipelines for natural gas, petroleum, slurries, and water are covered. Pipeline corrosion in sea water and soils is described. Methods of preventing

corrosion and testing for defects are included, (173 abstracts). GRA

N78-29231# National Technical Information Service, Springfield, Va.
PIPELINE CORROSION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - May 1978
Mona F. Smith May 1978 144 p
(NTIS/PS-78/0455/2-Vol-2) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Worldwide research is cited on corrosion and corrosion prevention of pipelines for natural gas, petroleum, water, slurries, and other gases and liquids. Pipes of steel, stainless steel, copper alloys, galvanized steel, concrete, and zinc alloys are the major materials studied. Prevention of corrosion by cathodic protection, coatings, wrappings, and linings are covered. The use of plastics for corrosion resistant pipes is included, (137 abstracts). GRA

N78-29232# National Technical Information Service, Springfield, Va.
TIN PLATING AND TIN PLATE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1978
Mona F. Smith May 1978 86 p Supersedes NTIS/PS-77/0293
(NTIS/PS-78/0477/6; NTIS/PS-77/0293) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Federally-funded research on solutions and processes for electroless coating and electroplating are cited. Studies on tin plated objects, their properties, soldering, welding, working, and corrosion are covered. Tin coating on nonmetal substrates is also included. GRA

N78-29233# National Technical Information Service, Springfield, Va.
TIN PLATING AND TIN PLATE. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - May 1978
Mona F. Smith May 1978 192 p Supersedes NTIS/PS-77/0294
(NTIS/PS-78/0478/4 ; NTIS/PS-77/0294) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Abstracts of worldwide research are presented on tin coating processes and properties. Studies on baths, additives, and electrolytes are included. Topics covered are corrosion, soldering, forming, quality control, and performance of tin plate. The majority of articles described are containers or circuit boards. GRA

N78-29234# Battelle Columbus Labs., Ohio.
CORROSION FATIGUE OF CAST PROPELLER ALLOYS IN FLOWING SEAWATER Final Report, 19 Jan. 1973 - 31 Jul. 1977
Carl E. Jaske, David A. Utah, and Walter K. Boyd Jul. 1977 96 p refs
(Contract MA-3-36208)
(PB-279337/0; MA-RD-920-77085-A) Avail: NTIS HC A05/MF A01 CSCL 13I

The corrosion fatigue results of bronze alloys-manganese, ABS Type 2, nickel-aluminum, ABS Type 4, and manganese-nickel-aluminum, ABS Type 5 are presented. Some results on CA-6NM stainless steel are also given. The large Krause type plate-bending specimens are from large castings to simulate those from ship propellers. Fatigue experiments were carried out for various mean and alternating stress levels at 3.33 HZ. Stress versus number of cycles to failure (S-N) between 1,000,000 and 10 to the 8th power cycles are given for the three bronzes, which includes the effect of mean stress levels. The mean stress effects could be well accounted for by the use of the Smith stress-strain parameter. Results are discussed in terms of alloy and published information. Application of the results to design is also addressed. GRA

N78-29235# National Technical Information Service, Springfield, Va.
CHEMICAL ANALYSIS OF STEEL. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - May 1978
Mona F. Smith May 1978 214 p Supersedes NTIS/PS-77/0418; NTIS/PS-76/0415; NTIS/PS-75/289
(NTIS/PS-78/0491/7; NTIS/PS-77/0418; NTIS/PS-76/0415; NTIS/PS-75/289) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

Information is cited on chemical analysis of boron, nitrogen, hydrogen, sulfur, silicon, carbon, oxygen, aluminum, rare earths, and other trace elements in steel. In addition, research on the determination of major elements, including iron, is covered. New techniques and refinement of older techniques, including X-ray fluorescence, spectroscopy, chromatography, activation analysis, and wet chemical methods are also included. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-29236 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE KINETICS OF TWO-PHASE EMULSION POLYMERIZATION Ph.D. Thesis
Chi Woon Chiu 1978 155 p
Avail: Univ. Microfilms Order No. 7811502

A dilatometric method was used to investigate the kinetics of producing two phase polymers by emulsion polymerization. This involved monitoring the rate of the glassy monomer reaction when it was mixed with a rubber latex and initiator in a dilatometer. Styrene was chosen as the glassy monomer. The rubber latexes used include polybutadiene and polyethylacrylate. Polystyrene latex was also used, mainly as the basis for comparison. Experiments were performed at various temperatures, rubber particle concentrations, initiator concentrations and particle sizes. The polymerization of styrene was found to go on almost exclusively on the existing polymer particles. The monomer concentration in a rubber polymer particle was found to decrease drastically when a trace amount of polystyreene was introduced. Strong evidence of flocculation was found for polyethylacrylate seeded polymerization. Dissert. Abstr.

N78-29237 Case Western Reserve Univ., Cleveland, Ohio.
METASTABLE DIAMOND SYNTHESIS AND THE RATE OF CARBON FORMATION ON DIAMOND Ph.D. Thesis
John Michael Forgac 1978 368 p
Avail: Univ. Microfilms Order No. 7809275

The rate of carbon formation on diamond via methane pyrolysis was investigated in a search for better conditions for metastable diamond growth. Pressures from 1 to 55 atmospheres and temperatures from 800 to 1350 C were studied. Methane-hydrogen and methane-helium gas mixtures were used. Conditions near reaction equilibrium were emphasized at concentrations up to 70% methane. A pressurized thermobalance was shown to be a useful tool for obtaining gas-solid reaction information at severe conditions. The rate of carbon formation near reaction equilibrium conditions was found to be amenable to a nucleation interpretation. Finally, conditions that permit the formation of metastable diamond were identified. Dissert. Abstr.

N78-29238 Case Western Reserve Univ., Cleveland, Ohio.
THEORETICAL ANALYSIS OF SOLVENT EFFECTS ON POLYMER CONFORMATION Ph.D. Thesis
Kenneth Harold Forsythe 1978 147 p
Avail: Univ. Microfilms Order No. 7809276

A polymer-solvent interaction model, based upon the concept of a hydration shell, was used to evaluate the free energy of solvation of many different homopolypeptides in aqueous solution. The conformational properties of L-alanine chains and both cis- and trans L-proline chains were also calculated as a function of interaction with various solvents and chain length. The solvents considered were water, methanol, ethanol, formic acid, and acetic acid. The hydration shell model was used to compute the macromolecule-solvent interactions. The conformational properties of the molecules in vacuo were also computed and used as references. The behavior of the S-peptide of ribonuclase-S as it migrates from the parent protein in vacuo, and in aqueous and acid media was simulated. Dissert. Abstr.

N78-29239 Massachusetts Univ., Amherst.
LINEAR POLYBENZYL DERIVATIVES Ph.D. Thesis
John Earl Chandler 1978 178 p
Avail: Univ. Microfilms Order No. 7810696

Friedel-Crafts polycondensation of 1-chloroethlbenzene, 2,5-dimethylbenzyl chloride, 3,4-dimethylbenzyl chloride, and 2-methyl-5-isopropylbenzyl chloride was used to prepare linear polybenzly derivatives which were examined for linearity, molecular weight, thermal stability, solubility, and film-forming capabilities. Low temperature conditions (-125 deg to -40 deg) were used in the polymerization reactions of 1-chloroethylbenzene involving complexed and uncomplexed A1C13 catalyst at various concentration ratios. The model compound reactions of optically active and racemic 1-chloroethylbenzene with t-butylbenzene at -125 deg were performed to study the mechanism of the polycondensation of 1-chloroethylbenzene. Dissert. Abstr.

N78-29240 Massachusetts Univ., Amherst.
HIGH-PRESSURE X-RAY DIFFRACTION STUDY OF LINEAR POLYETHYLENE Ph.D. Thesis
Kenneth Paul Rozkuszka 1978 169 p
Avail: Univ. Microfilms Order No. 78-10748

An opposed diamond anvil high-pressure cell is used in conjunction with wide angle X-ray diffraction techniques to provide a quantitative description of the behavior and structure of the polyethylene crystal lattice. X-ray diffraction of the polycrystalline sample subjected to a pressure, while compressed between the diamond anvils, permits the measurement of lattice parameters as a function of increasing pressure. The isothermal P-V relationships may be obtained from the lattice parameters and from pressure values determined utilizing an internal pressure standard, sodium chloride. By means of this technique, the response of the polyethylene orthorhombic crystal lattice to pressures up to 8 kilobars was examined from -75 C to 125 C at 25 D intervals. Values for the linear compressibility and linear thermal expansivity in the a, b and c axis directions were obtained, hence a quantitative measure of the thermomechanical anisotropy of the polyethylene unit-cell. Volume data were obtained from a knowledge of the pressure and temperature response of the three crystallographic axes. Dissert. Abstr.

N78-29241 Pennsylvania State Univ., University Park.
POLYMERIC REPLAMINEFORM BIOMATERIALS AND A NEW MEMBRANE STRUCTURE Ph.D. Thesis
William Michael Hanysiak 1977 142 p
Avail: Univ. Microfilms Order No. 7804226

This study was undertaken to advance vascular prosthesis and membrane oxygenator design with the aid of the replamineform techniques and precursors (porous marine calcium carbonate). Techniques were developed for the formation of porous small diameter (4 mm) vascular prostheses with three pore sizes and composed of six biomedical polymers. Due to the relative success of these protheses, it became feasible for the first time to develop a sensitive animal implant model for the systematic evaluation of pore size and compositional effects on the healing and patency of small diameter vascular prostheses. From in vivo animal testing performed at two major hospitals, it was determined that the healing and patency of the prostheses varied with their composition, and that the healing and patency were not directly related. Silicone rubber prostheses exhibited the best patency (90% in two weeks), but had almost no tissue ingrowth through the porous wall. Dissert. Abstr.

N78-29242# British Library Lending Div., Boston Spa (England).
STUDY OF THE AGEING EFFECTS OF STYRENE COPOLYMERS
10 Aug. 1977 12 p refs Transl. into ENGLISH from Caoutchoucs et Plastiques (Paris), Nov. 1976 p 83-93
(BLL-PO-Trans-3502-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The long term behavior of copolymers modified with polybutadiene are investigated. In question are the nonpigmented commercial polymers, samples of which were aged naturally by exposure at an angle of 45 degrees to the south. The energy received by each sample was measured at 100 kcal/sq cm which corresponds to a one year's exposure. The aging properties investigated were: flexural strength; tensile strength; and impact strength. Infrared spectroscopy was used to study the photo-oxidation reactions on the surface of the sample subjected to the aging process. A discussion is presented on protection systems against aging such as (1) internal protection -- organic mineral compounds reacting with free radicals or absorption of harmful radiation altering the behavior and adding protection, pigments, and anti-oxygens; (2) external protection -- rigid or semirigid PVC film, paints or varnishes, and metallizing.
G.Y.

N78-29243# British Library Lending Div., Boston Spa (England).
TESTING THE STABILITY OF HIGH-DENSITY POLYETHYLENE
Endre Banai, Szilvia Orban, and Laszlo Bezur 3 Feb. 1978 15 p refs Transl. into ENGLISH from Muanyag Gumi (Budapest), v. 13, no. 12, 1976 p 373-376 Presented at Plastics Conf., Esztergom, Hung.; sponsored by Hung. Chem. Soc.
(BLL-PO-Trans-3564-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

Changes in the mechanical properties of polyethylese of various degrees of stabilization were determined from the effects of natural and artificial aging. Injection molded cage boxes and delivery containers were subjected to tensile to strength, pressure stability, and wetting agent stress corrosion tests to assess their outdoor durability. Resistance to photooxidation of stabilized and unstabilized dense polyethylenes was studied and as well as the percentage of change in tensile strength of polyethylene aged for 2,000 hours in a Xenotest apparatus. Results indicate that the quantity of oxygen uptake can be 2 ml or less for polyethylenes intended for five years' outdoor use. A.R.H.

N78-29244 Utah Univ., Salt Lake City.
INTERACTION OF WATER WITH HYDROPHILIC METHACRYLATE POLYMERS Ph.D. Thesis
Yong Kiel Sung 1978 177 p
Avail: Univ. Microfilms Order No. 7808319

Differential scanning calorimetry water vapor sorption measurements, and pulse NMR relaxation spectroscopy were used to study the interactions of water with the hydrophilic methacrylate polymers. It is proposed that the interactions of water with hydrophilic polymers occur in four ways: (1) Water molecules are strongly bound to specific sites such as hydroxyl or carboxyl groups within the polymer network; dynamically and thermodynamically they behave as part of the chains. (2) Water molecules are weakly bound to the hydrophilic sites and/or preferentially structured around the polymer network. (3) Water molecules behave as though they are in the presence of a high concentration of solute, i.e., freezing point depression. (4) Water molecules behave dynamically and thermodynamically as bulklike or free water. Dissert. Abstr.

N78-29245*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURELESS SINTERED BETA PRIME-Si3N4 SOLID SOLUTION: FABRICATION, MICROSTRUCTURE, AND STRENGTH
Sunil Dutta 1977 19 p refs Presented at the Fall Meeting of the Basic Sci. Div. of the Am. Ceramic Soc., Hyannis, Mass., 25-28 Sep. 1977
(NASA-TM-78950) Avail: NTIS HC A02/MF A01 CSCL 11B

Si3N4, AlN, and Al2O3 were used as basic constituents in a study of the pressureless sintering of beta prime-Si3N4 solid solution as a function of temperature. Y2O3-SiO2 additions were used to promote liquid-phase sintering. The sintered specimens were characterized with respect to density, microstructure, strength, oxidation, and thermal shock resistance. Density greater than 98 percent of theoretical was achieved by pressureless sintering at 1750 C. The microstructure consisted essentially of fine-grained beta prime-Si3N4 solid solution as the major phase. Modulus of rupture strengths up to 483 MPa were achieved at moderate temperature (1000 C), but decreased to 228 MPa at 1380 C. This substantial strength loss was attributed to a glassy grain boundary phase formed during cooling from the sintering temperature. The best oxidation resistance was exhibited by a composition containing 3 mol % Y2O3-SiO2 additives. Water quench thermal shock resistance was equivalent to that of reaction sintered silicon nitride but lower than hot-pressed silicon nitride. A.R.H.

N78-29246*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUBSTITUTION OF CERAMICS FOR HIGH TEMPERATURE ALLOYS
H. B. Probst 1978 19 p refs Presented at the 14th State-of-the-Art Symp. on Scarce and Critical Mater., Washington, D. C., 5-7 June 1978; sponsored in part by the Am. Chem. Soc., the Federation of Mater. Soc. and the Am. Soc. for Metals
(NASA-TM-78931; E-9674) Avail: NTIS HC A02/MF A01 CSCL 11C

The high temperature capability of ceramics such as silicon nitride and silicon carbide can result in turbine engines of improved efficiency. Other advantages when compared to the nickel and cobalt alloys in current use are raw material availability, lower weight, erosion/corrosion resistance, and potentially lower cost. The use of ceramics in three different sizes of gas turbine is considered; these are the large utility turbines, advanced aircraft turbines, and small automotive turbines. Special consideration, unique to each of these applications, arise when one considers substituting ceramics for high temperature alloys. The effects of material substitutions are reviewed in terms of engine performance, operating economy, and secondary effects. A.R.H.

N78-29247# Naval Civil Engineering Lab., Port Hueneme, Calif.
EFFECTIVENESS OF OVER-RUST PRIMER FOR NAVAL SHORE FACILITIES Technical Report, Jul. 1971 - Jun. 1976
E. S. Matsui Jan. 1978 60 p refs
(YF54593012)
(AD-A053557; CEL-TR-863) Avail: NTIS HC A04/MF A01 CSCL 11/3

Various over-rust primers top-coated with government specification paint TT-E-489D were applied over brush-off sandblasted and wire-brushed rusted steel specimens and were exposed 5 yr at three Civil Engineering Laboratory (CEL) marine atmospheric test sites. The performance of the coating system at the CEL test sites was compared with that of the government specification test standard coated over sandblasted, brush-off sandblasted, and wire-brushed steel specimens. The results indicate that a coating system using a superior over-rust primer can provide protection comparable to that of the test standard applied over the sandblasted steel specimens. However, most of the over-rust primers tested provided less protection than the test standard. A test standard coated with a wash primer (Formula 117) provided poorer protection than the same coating system without the wash primer when applied over the rusted steel specimens. Estimating anticipated durability of coating system at one site from data obtained from another site by a regression analysis is also illustrated. Author (GRA)

N78-29248# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
HIGH TEMPERATURE MECHANICAL PROPERTIES OF POLYPHASE CERAMICS BASED ON SILICON NITRIDE Annual Report, 1 Feb. 1977 - 31 Jan. 1978
F. F. Lange Mar. 1978 91 p refs
(Contract F49620-77-C-0072)
(AD-A054342; SC5099.1IR; AFOSR-78-0943TR) Avail: NTIS HC A05/MF A01 CSCL 11/2

Progress is summarized in the following study areas: (1) eutectic studies in the Si3N4-MgO-SiO2 system relating eutectic compositions and temperatures to fabrication, microstructure and mechanical properties; (2) evidence for high temperature cavitation crack growth in polyphase Si3N4 materials; (3) estimates of the time required for the stress induced penetration of a liquid from triple points to locations between grains; (4) the reaction of Fe with polyphase Si3N4 to form surface pits during oxidation which lead to strength degradation, (5) creep behavior of polyphase Si3N4/MgO alloys in relation to the MgO/SiO2 molar ratio and cavitation. Author (GRA)

N78-29249# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
MOLECULAR BEAM SAMPLING MASS SPECTROMETRY OF HIGH HEATING RATE OF HMX IN A POLYURETHANE BINDER
Richard A. Beyer Mar. 1978 22 p refs
(DA Proj. 1L1-61102-AH-60)
(AD-A054328; AD-E430016; ARBRL-MR-02816) Avail: NTIS HC A02/MF A01 CSCL 19/1

The data acquisition capability of the time-of-flight mass spectrometer used with the molecular beam sampling system has been expanded. An oscilloscope intensity-modulated raster technique using negative film scanned by a microdensitometer provides simultaneous semi-quantitative time-resolved mass spectra of all masses up to 160 amu with time resolution down to 10 ms. A system of parallel sample/hold channels which follow predetermined masses with time resolution near that of the spectrometer cycle time has been assembled and shown to have good dynamic range, adequate mass resolution, and provide good reproducibility. This system has been used to study the products of low pressure pyrolysis of nitrocellulose and cyclotetramethylene tetranitramine/polyurethane binder. Using a carbon dioxide laser for heating the samples up to 5000 deg/s heating rate effects are clearly demonstrated for NC but are not observed for HMX/PU. Relative amounts of the major decomposition species observed for the HMX/PU were nitrous oxide, 100; nitrogen dioxide, 54; hydrogen cyanide, 42; formaldehyde, 39; and nitric oxide, 27. The large amounts of nitrogen dioxide is compatible with the breaking of the N-N bond as the first step of the thermal decomposition of HMX. Author (GRA)

N78-29250# Vermont Univ., Burlington. Dept. of Chemistry.
SYNTHESIS, MAGNETIC SUSCEPTIBILITY, AND MOESSBAUER SPECTRA OF Fe(III) DIMERS AND Fe(II) POLYMERS CONTAINING 2,5-DIHYDROXY-1,4-BENZOQUINONES
James T. Wrobleski and David B. Brown 22 May 1978 43 p refs
(Contract N00014-75-C-0756)
(AD-A054678; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/3

Several iron complexes of the dianions of 2,5-dihydroxy-1,4-benzoquinone (DHBQ) and 2, 5-dichloro-3,6-dihydroxy-1,4-benzoquinone (CA, chloranilate dianion) have been prepared and studied by magnetic susceptibility and Moessbauer spectroscopic methods. Iron(II) salts react with these dihydroxybenzoquinones to give polymeric Fe(DHBQ)(H2O)2 and Fe(CA)(H2O)2. If the reaction is carried out in the presence of pyrazine, pyr, (Fe(CA)(pyr))(n) and (Fe(DHBQ)(pyr)) are obtained. Infrared spectral results are consistent with the presence of bridging bidentate pyr in these complexes, and thus sheet polymers. Dimeric Fe2(DHBQ)3(H2O)4 and Fe2(CA)3(H2O)4 .4H2O are obtained by reacting FeCl3 with the respective dihydroxybenzoquinones. Magnetic susceptibility vs. temperature data obtained for the polymeric materials are fit to a S=2 Heisenberg linear chain model. The presence of an anisotropy in the recoilless fraction (Goldanskii-Karyagin effect) is observed in the Fe57 Moessbauer spectra of the Fe(III) dimers and is substantiated by measurements on the temperature dependence of the Moessbauer parameters. GRA

N78-29251# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
GRAIN BOUNDARY ENERGETICS IN NON-OXIDE CERAMICS Final Technical Report, 1 Feb. 1975 - 31 Jan. 1978
A. H. Heuer and T. E. Mitchell 28 Feb. 1978 12 p
(Contract AF-AFOSR-2789-75)
(AD-A054179; AFOSR-78-0698TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

Research on 'Grain Boundary Energetics in Non-Oxide Ceramics' has been conducted at CWRU since 1975 and has concentrated on two specific areas--the beta to alpha transformation in polycrystalline SiC, and the nature of grain boundary phases in hot-pressed Si3N4 containing various densification aids. The beta to alpha transformation in polycrystalline SiC is unusual in that it appears to occur in two stages. The first involves the growth of composite plates consisting of alpha-SiC plates sandwiched between recrystallized envelopes of beta SiC. This stage ends when the original polycrystalline beta matrix is consumed. The second and more sluggish stages involves the thickening of the alpha plates within their beta envelopes and requires repeated piecewise nucleation of alpha at the beta to alpha interface. High resolution TEM has been used to show that the commercial MgO-doped hot-pressed Si3N4 apparently

contains a continuous grain boundary phase that is responsible for the poor high-temperature performance. Grain boundary microstructures have been characterized in polycrystalline Si3N4 containing Y2C3, ZrO2, and BeSiN2; the latter additive appears to be the most promising, since a continuous grain boundary film is not present. Author (GRA)

N78-29252# General Electric Co., Philadelphia, Pa. Space Div.
METHODS OF FABRICATING CERAMIC MATERIALS Final Report, 15 Apr. 1974 - 15 Apr. 1977
Arno Gatti and Michael J. Noone Wright-Patterson AFB, Ohio Nov. 1977 137 p refs
(Contract F33615-74-C-4073)
(AD-A054043; AFML-TR-77-135) Avail: NTIS HC A07/MF A01 CSCL 11/2

Processing parameters are described which allow the fabrication of high density 'Sialon' compositions using conventional ceramic technology amenable to low-cost large-scale production. A processing technique, 'mineralization' is used to incorporate sintering aids into the Al2O3 component of the sialon which facilitates control and minimization of the amount of such additives while simultaneously extending the firing range of the materials. Sialons containing up to 87% by weight of Si3N4 are densified by pressureless sintering in an atmosphere of N2-H2 with negligible weight loss. Properties discussed include bend strength of up to 60,000 psi at room temperature with good strength retention in several compositions to 1400 C and oxidation resistance superior to hot pressed Si3N4. The fabrication of Radome Shapes by slip casting and jiggering and of turbine blade shapes by injection molding are demonstrated.
Author (GRA)

N78-29253# Dayton Univ., Ohio. Research Inst.
A PRELIMINARY INVESTIGATION OF THE INTERACTION OF M-50 STEEL WITH A PERFLUOROALKYLETHER FLUID AND A 1 PERCENT ADDITIVE-FLUID FORMULATION Interim Technical Report, 1 Mar. 1976 - 1 Mar. 1977
T. N. Wittberg, C. A. Svisco, and W. E. Moddeman Wright-Pattern AFB, Ohio AFML Jul. 1977 35 p
(Contracts F33615-75-C-5095; MIPR-FY1457-76-00451)
(AD-A054044; UDRI-TR-76-83; AFML-TR-77-125) Avail: NTIS HC A03/MF A01 CSCL 11/6

Electron spectroscopy for chemical analysis (ESCA) has been used to characterize the passivation film formed on the surface of M-50 steel coupons during O-C testing in a perfluoroalkylether fluid containing a perfluoroalkylether aryl phosphine additive. Prior to analysis of the metal coupons, samples of the additive and fluid which had not undergone O-C testing were characterized with ESCA. The measured atom percent compositions of the fluid and additive were found to agree well with the compositions ascertained from the formulae. Freshly polished metal coupons were analyzed and were found to contain high levels of carbon and oxygen surface contamination. On coupon which had undergone O-C testing in additive-fluid formulations, surface phosphorous levels were found to be roughly five times greater than in the additive alone. This data suggests that in the protective action afforded during the O-C test, the additive has changed chemistry. Author (GRA)

N78-29254# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
WATER VAPOR PERMEABILITY OF PLASTIC FAST PACKS
John A. Hincks Apr. 1978 15 p refs
(AD-A054509; PTPT-78-9) Avail: NTIS HC A02/MF A01 CSCL 11/9

The objective of this investigation was to perform nondestructive tests that quantitatively measured the water vapor permeability of a plastic (high density polyethylene) Type I Fast Pack design. The water vapor transmission rate (WVTR) of the new pack design was found to be much less than the 0.02 grams/100 square inch/24 hour maximum allowed for the MIL-B-131 barrier material bags or pouches used in the original fiberboard Type I Fast Packs. The plastic Fast Pack container, itself, acts as the low WVTR barrier which protects against moisture penetration while the polyurethane foam cushioning affords mechanical and physical protection. Author (GRA)

N78-29255# Sandia Labs., Albuquerque, N. Mex.
ENTANGLED POLYMERS: POLYSTYRENE IN BUTANONE
D. W. Schaefer 1978 8 p refs Presented at the Div. of Fuel Chem. Meeting, Anaheim, Calif., 12 Mar. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1734C; Conf-780305-4) Avail: NTIS HC A02/MF A01

Inelastic light scattering is used to probe the dynamics of polystyrene in butanone. Three distinct types of dynamical phenomena were examined. In the semidilute regime, above the concentration at which the chains overlap and entangle, scaling behavior is observed. At small angles, the self diffusion constant is measured to be 2.0 + or - .1 x 10 to the -7th power sq cm/sec, a value consistent with earlier work. At larger angles the initial decay rate of the intensity correlation function scales is proportional to K2.64, where K is the magnitude of the scattering vector. ESA

N78-29256# Sandia Labs., Albuquerque, N. Mex. Composite Materials Development Div.
KEVLAR 49-EPOXY INSULATOR
R. H. Erickson Jan. 1978 19 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0500) Avail: NTIS HC A02/MF A01

Kevlar 49 Epoxy composite structural insulators were fabricated from two and three dimensionally reinforced material. The insulator configuration was that of a cylindrical cup having both external and internal threads. Electrical and mechanical property data were obtained for test samples of both materials. Relatively little difference in electrical properties was obtained for the two materials, however, the mechanical properties varied markedly. The transverse strength of the two dimensionally reinforced material was 2000 psi in tension as compared with 110,000 psi in compression. In the three dimensionally reinforced composite the difference was less, 57,400 psi in tension and 72,000 psi in compression. These properties are described along with the techniques used to fabricate prototype parts of the two composites. ERA

N78-29257# Sandia Labs., Albuquerque, N. Mex.
REINFORCED ELASTOMERS AND FRICTION SUPPORTS: MODERN METHODS OF ANTISEISMIC SUPPORT
C. Plichon Jan. 1978 38 p refs Transl. into ENGLISH from the Proc. of the Specialist Meeting on the Antiseismic Design of Nucl. Installations, OECD-Paris, 1-3 Dec. 1975 p 203-227 Sponsored by DOE
(SAND-78-6001) Avail: NTIS HC A03/MF A01

The advantages of suspending a building or a group of buildings on elastic supports of artificial rubber are discussed briefly. These supports, which are commonly employed to support prestressed concrete bridges in Europe and particularly in France, decouple heavy structures from horizontal seismic excitation. This decoupling limits the horizontal acceleration to a prespecified value, completely eliminates rocking movements and substantially simplifies seismic calculations for materials, since the peak floor response spectrum is at a frequency much below theirs. If the earthquake is too severe, a horizontal friction surface is added to the elastic supports. This introduces a nonlinearity that can be controlled perfectly and permits an ordinary structure to support an arbitrary horizontal acceleration. ERA

N78-29258# Research Inst. of National Defence, Stockholm (Sweden).
PENETRATION OF SOLVENTS IN PLASTIC MATERIAL Progress Report [PENETRATION AV LOESNINGSMEDEL GENOM PLASTMATERIAL LAEGESRAPPORT]
Allan Linnarson Oct. 1977 18 p refs In SWEDISH Sponsored by Fund for Worker's Protection
(FOA-C-20201-H2) Avail: NTIS HC A02/MF A01

Membranes cut from plastic protective polynyl chloride, neoprene rubber or neoprene-butyl gloves were tested for their permeability to various organic solvents, both pure and mixed, and to jet fuel. Testing of the membranes was carried out in a test set connected to a mass spectrometer (LKB 2091). Experiments show that penetration characteristics vary with the composition of the test mixture. Thus a certain plastic material may be perfectly impenetrable for a certain pure component. If this component is present in a mixture with a penetrating

component, both will penetrate. The mechanism of this phenomenon is probably that the plastic is softened by one component, facilitating penetration for the others. Experiments also show that penetration time for the components in a mixture changes towards the time of the fastest component. All experiments were carried out at room temperature (20 C). Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-29259# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

METHANOL AS A POSSIBLE FUEL FOR AUTOMOTIVE USE

G. G. Lucas and M. F. Choi Jul. 1977 35 p refs

(TT-7708) Avail: NTIS HC A03/MF A01

The state-of-the-art of the use of methanol in internal combustion engines is reviewed. Fuel economy, power output and emission characteristics of methanol-fuel vehicles are reported. Problems associated with automobiles operating with straight methanol are identified. Existing processes for the manufacture of methanol are described, and further raw material sources for methanol production and uses are assessed. F.O.S.

N78-29260# Arizona Univ., Tucson.

INVESTIGATING MAPPING TECHNIQUES FOR ELUCIDATING PROCESSES OCCURRING IN PYROTECHNIC FLAMES AND THEIR FLAME ANALOGS Final Technical Report

M. Bonner Denton Dec. 1977 27 p

(Contract N00019-76-C-0510)

(AD-A053373) Avail: NTIS HC A03/MF A01 CSCL 19/1

Studies into the implementation and use of computer automated high-speed mapping techniques are described. Considerations involved in the development of experimental hardware and software are discussed. Data is presented detailing the systems' present performance. Author (GRA)

N78-29261# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.

PROCEEDINGS OF THE CONFERENCE ON ENVIRONMENTAL CHEMISTRY OF HYDRAZINE FUELS Final Report

Mar. 1978 175 p Conf. held at Tyndall AFB, Fla., 13 Sep. 1977

(AF Proj. 1900)

(AD-A054194; CEEDO-TR-78-14) Avail: NTIS HC A08/MF A01 CSCL 21/9

On 13 September 1977, the Civil and Environmental Engineering Development Office, ADTC, Tyndall AFB, Florida, hosted a conference on the environmental chemistry of hydrazines used for missile fuels and monopropellants. A total of 14 papers were presented on the following general topics related to hydrazine fuels: (1) Sources and Control of Fuels Emissions and Spills (2) Environmental Monitoring Techniques and Instrumentation (3) Analysis of Fuels and Degradation Products (4) Fate of Hydrazines in the Environment. Author (GRA)

N78-29262# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

HYDROGEN CONTENT OF HYDROCARBON FUELS BY A LOW-RESOLUTION NUCLEAR RESONANCE METHOD Interim Technical Report, 20 Jul. - 20 Aug. 1977

Ronald D. Butler Dec. 1977 30 p refs

(AD-A054465; AFAPL-TR-77-61) Avail: NTIS HC A03/MF A01 CSCL 21/4

A low-resolution (wide-line) nuclear magnetic resonance (NMR) technique has been evaluated for the direct, nondestructive determination of the hydrogen content of aircraft and missile fuels. The method is rapid and convenient, and requires minimal operator training. Accuracy and precision of the results compare favorably with the best microcombustion techniques.

Author (GRA)

N78-29263# Catalytica Associates, Inc., Palo Alto, Calif.

EVALUATION OF SULFUR-TOLERANT CATALYTIC PROCESSES FOR PRODUCING PEAK-SHAVING ALCOHOL FUELS Final Report

Feb. 1978 70 p refs

(EPRI-AF-687) Avail: NTIS HC A04/MF A01

The objective was to determine the economic incentive for developing a sulfur-tolerant methanol synthesis catalyst. Economic evaluations were performed on ten conceptual methanol synthesis processes. Synthesis gas feeds of varying sulfur content were used. A literature and industry survey for the availability of such a sulfur-tolerant catalyst was also performed. Little economic incentive was found for the development of such a catalyst. It was also found that there is now no known sulfur-tolerant catalyst that has sufficient activity for commercial application. ERA

N78-29264# Research Inst. of National Defence, Stockholm (Sweden).

DEVELOPMENT AND CHARACTERIZATION OF ANALYSIS METHODS FOR CONTROL OF HIGHLY CONCENTRATED HYDRAZINE [FRAMTAGNING OCH KARAKTAERISERING AV ANALYSMETODER FOER KONTROLL AV HOEGKONCENTRERAD HYDRAZIN]

Lars-Henrik Andersson, Birgit Gelin, and Eyvind Helleday Jan. 1978 11 p refs In SWEDISH

(FOA-C-20213-D3) Avail: NTIS HC A02/MF A01

In order to control highly concentrated hydrazine, used in rocket propellants, methods for determination of hydrazine contents and trace elements in the form of metallic contaminants were developed. The hydrazine content is determined by titrating with potassium iodate in 6M hydrochloric acid, where the final point is indicated potentiometrically. Metallic contaminants are determined in a separate experiment where the hydrazine is split by oxidation with hydrogen peroxide. The solution with the contaminants is evaporeduced to copper electrodes that are then pairwise excited by a high voltage spark; the emission spectra are registered on photographic plates that are then evaluated. Author (ESA)

N78-29265# Research Inst. of National Defence, Stockholm (Sweden).

DETERMINATION OF RDX IN UC-36 [BESTAEMNING AV RDX I UC-36]

Tom Karlsson Jan. 1978 7 p refs In SWEDISH

(FOA-C-20216-D1) Avail: NTIS HC A02/MF A01

A colorimetric method for determination of the RDX content in the explosive UC-36 is described. The method is based on the fact that in an alkaline environment RDX dissipates nitrite which is determined quantitatively with Griss' reagent (Salzman method). The reproducibility of the method lies around + or - 0.7 % (triple test). The nylon present in UC-36 gives no effects. Author (ESA)

N78-29266# National Technical Information Service, Springfield, Va.

SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WASTES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1978

Audrey S. Hundemann May 1978 122 p Supersedes NTIS/PS-77/0112; NTIS/PS-76/0795; NTIS/PS-75/655 (NTIS/PS-78/0499/0; NTIS/PS-77/0112; NTIS/PS-76/0795; NTIS/PS-75/655) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

Research efforts directed toward production of gaseous and liquid synthetic fuels from solid wastes are discussed. Waste products used in the syntheses include manure, sewage, paper, and wood. In most citations, methane is the primary fuel produced; however, the production of oils, ammonia, carbon monoxide, and methyl alcohol is also discussed. This updated bibliography contains 116 abstracts. GRA

N78-29267# National Technical Information Service, Springfield, Va.

SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WASTES. CITATIONS FROM THE AMERICAN PETROLEUM WASTE INSTITUTE DATA BASE Progress Report, 1975 - Dec. 1977

Audrey S. Hundemann May 1978 295 p Supersedes NTIS/PS-77/0113

(NTIS/PS-78/0500/5; NTIS/PS-77/0113) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

The bibliography cites worldwide literature on the production of fuels from waste materials, such as animal manure, wood chips, sewage sludge, urban garbage, agricultural wastes, and old automobile tires. This updated bibliography contains 284 abstracts. GRA

N78-29268# National Technical Information Service, Springfield, Va.

UNDERGROUND COAL GASIFICATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1978

May 1978 200 p Supersedes NTIS/PS-77/0477; NTIS/PS-76/0407

(NTIS/PS-78/0485/9; NTIS/PS-77/0477; NTIS/PS-76/0407) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

The bibliography of Federally-sponsored research cites all aspects of in-situ gasification techniques, including rock fracturing, combustion, gas removal, economics, costs, and environmental factors. This updated bibliography contains 194 abstracts. GRA

N78-29269# National Technical Information Service, Springfield, Va.

UNDERGROUND COAL GASIFICATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - May 1978

Diane M. Cavagnaro May 1978 116 p Supersedes NTIS/PS-77/0478; NTIS/PS-76/0485

(NTIS/PS-78/0486/7; NTIS/PS-77/0478; NTIS/PS-76/0485) Avail: NTIS CSCL 21D

The bibliography presents worldwide research pertaining to underground (in-situ) coal gasification. It includes environmental effects, the different processes and techniques that are used, gas removal, rock fracturing, costs, and economics. This updated bibliography contains 109 abstracts. GRA

N78-29270# National Technical Information Service, Springfield, Va.

DESULFURIZATION OF COAL AND PETROLEUM, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - May 1978

Diane M. Cavagnaro May 1978 226 p Supersedes NTIS/PS-77/0434; NTIS/PS-76/0399; NTIS/PS-75/381; COM-74-10935

(NTIS/PS-78/0497/4; NTIS/PS-77/0434; NTIS/PS-76/0399; NTIS/PS-75/381; COM-74-10935) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

Aspects of coal and petroleum fuel desulfurization relating to coal preparation, coal liquids, the gasification of coal, and crude oil preparation, where the processes specifically accomplish desulfurization before combustion of the fuel are covered. Coal liquefaction and gasification are only included if sulfur removal is stressed. Flue gas desulfurization and other post-combustion sulfur control processes are excluded. This updated bibliography contains 220 abstracts. GRA

N78-29271# National Technical Information Service, Springfield, Va.

COAL TAR TECHNOLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report

Diane M. Cavagnaro May 1978 143 p

(NTIS/PS-78/0407/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

The citations include coal tar production from coal gasification, synthesis of chemicals from coal tar, toxicology, pollution, chemical analysis, and the use of coal tar as a wood preservative. GRA

N78-29272# Little (Arthur D.), Inc., Cambridge, Mass.

TECHNICAL MANUAL FOR THE ANALYSIS Final Report, Dec. 1976 - Dec. 1977

L. N. Davidson, W. J. Lyman, D. Shooter, and J. R. Valentine Dec. 1977 140 p refs

(Contract EPA-68-02-2150)

(PB-279196/0; EPA-600/7-77-143) Avail: NTIS HC A07/MF A01 CSCL 07D

The manual is for use as a guide in research projects concerned with fuel combustion. Basically, it describes and discusses standard methods of sampling and analysis for a variety of hydrocarbon fuels. The analyses covered are those of prime concern to the combustion engineer; no attempt is made to cover all analyses that may be required in a complete environmental assessment of any fuel combustion process. For each fuel covered, the manual indicates the analyses that are likely to be required, the preferred method of analysis, and available sampling procedures. For each method of analysis listed (preferred plus alternates, in many cases), the manual summarizes the method, discusses its applicability, and describes its precision. GRA

N78-29273# Kentucky Univ., Lexington. Dept. of Chemical Engineering.

SYNTHETIC OIL FROM COAL: THE ECONOMIC IMPACT OF FIVE ALTERNATIVES FOR MAKING HYDROGEN FROM COAL Final Report

H. F. Moore, E. T. Kim, and R. I. Kermode Jan. 1978 85 p refs Sponsored in part by Ashland Oil, Inc., Ky.

(Grant NSF AER-73-03259-A03)

(PB-279322/2; IMMR33-PD20-78) Avail: NTIS HC A05/MF A01 CSCL 07A

This study evaluated the effect of several hydrogen production configurations on the cost of syncrude produced by a general catalytic liquefaction process. The five cases analyzed were: partial oxidation of coal at 44.7,500, and 1000 psia; partial oxidation of char at 1000 psia; and, partial oxidation of process-derived vacuum bottoms at 1000 psia. Material balances for all cases were based on a total coal consumption of 25,000 tons per stream day (TPSD). This study showed that increasing the pressure of partial oxidation 44.7 to 1000 psia reduced the oil cost by 10 percent. This incremental savings in going from 500 to 1000 psia was only two percent, which may make this increase marginal. GRA

N78-29274# Webb Inst. of Naval Architecture, Glen Cove, N.Y. Center for Maritime Studies.

POSSIBLE FUTURE MARINE FUELS

Harry Silla Nov. 1977 34 p refs Sponsored by Dept. of Commerce, Wash., D.C.

(PB-279257/0; NMRC-KP-164) Avail: NTIS HC A03/MF A01 CSCL 21D

Several possible future synthetic fuels for marine transportation were compared. The production, handling, and utilization of these fuels are discussed. Particular emphasis was placed on hydrogen, ammonia, and hydrazine. The difficulty of predicting which one of the synthetic fuels will dominate made it necessary to keep abreast of developments with all the fuels. GRA

N78-29275# Radian Corp., Austin, Tex.

LOW- AND MEDIUM-Btu GASIFICATION SYSTEMS: TECHNOLOGY OVERVIEW Final Task Report, Sep. 1977 - Jan. 1978

Paul W. Spaite and Gordon C. Page Mar. 1978 95 p refs Prepared in cooperation with Spaite (Paul W.) Co., Cincinnati

(Contracts EPA-68-02-2147; EPA-68-02-2149)

(PB-279641/5; EPA-600/7-78-061) Avail: NTIS HC A05/MF A01 CSCL 07A

Systems or combinations of processes are described which are likely to be used for production of low- and medium-Btu gas from coal. This involved making judgements as to types of coals that would be processed, types of gasifiers (and auxiliary processes) which would be employed, and markets which would develop for gas from coal. Three main sections are discussed: (1) status of technology gives a relatively broad definition of future prospects for coal gasification; (2) description of technology gives more specific information on processes that are likely to be used commercially; and (3) environmental impacts discusses the kinds of pollutant discharges that must be anticipated. GRA

N78-29063*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROGRESS ON COAL-DERIVED FUELS FOR AVIATION SYSTEMS

Robert D. Witcofski *In its* CTOL Transport Technol., 1978 1978 p 927-950 refs (For primary document see N78-29046 20-01) Avail: NTIS HC A18/MF A01 CSCL 21D

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-29276*# Horizons Research, Inc., Cleveland, Ohio.
HIGH RESOLUTION MASKS FOR ION MILLING PORES THROUGH SUBSTRATES OF BIOLOGICAL INTEREST
Sandra S. Donovan Jun. 1978 41 p refs
(Contract NAS3-21054)
(NASA-CR-135435; HRI-391) Avail: NTIS HC A03/MF A01 CSCL 13H

The feasibility was investigated of electrochemically oxidizing vapor deposited aluminum coatings to produce porous aluminum oxide coatings with submicron pore diameters and with straight channels normal to the substrate surface. Porous aluminum oxide coatings were produced from vapor deposited aluminum coatings on thin stainless steel (304), copper, Teflon (FEP) and Kapton substrates and also on pure aluminum substrates. Scanning electron microscope examination indicated that porous oxide coatings can be produced with straight channels, appropriate pore diameters and none or minimal intervening residual aluminum. The oxide coatings on the copper and Kapton substrates had the straightest channels and in general were superior to those fabricated on the other substrate materials. For oxide coatings fabricated at 600 V and 300 V, pore diameters were 0.4-0.6, and 0.3 micron with center-to-center spacing of 0.7-0.8, and 0.4 micron, respectively. Estimated direct labor and materials costs to prepare an oxide mask is anticipated to be about $4-$6 per square foot. F.O.S.

N78-29277# Johns-Manville Research and Development Center, Denver, Colo. Research and Development Center.
EFFECTIVENESS OF BUILDING INSULATION APPLICATIONS Final Report
J. D. Verschoor Port Hueneme, Calif. NCEL Nov. 1977 124 p refs
(Contract N68305-77-C-0009)
(AD-A053452; CEL-CR-78.006) Avail: NTIS HC A06/MF A01 CSCL 13/3

Conduction heat transfer was measured through ten fiberglass insulated wall and ceiling test panels. Three with R-7, R-11, and R-19 (Ceiling) insulation were reference panels. Seven panels with voids, overlaps, and fixtures were compared to the reference panels. Only the void showed marked increase in conduction loss. Work was performed under Phase I of the contract. Evaluation of the same panels for convection loss is being contemplated. Author (GRA)

N78-29278# Texas Univ. at Austin. Center for Highway Research.
STRENGTH AND BEHAVIOR OF ANCHOR BOLTS EMBEDDED NEAR EDGES OF CONCRETE PIERS Final Report
G. B. Hasselwander, J. O. Jirsa, J. E. Breen, and K. Lo May 1977 133 p refs Sponsored by DOT
(PB-279376/8; CFHR-3-5-74-29-2F; FHWA/RD-78-S0696)
Avail: NTIS HC A07/MF A01 CSCL 13C

The effects of bolt diameter, embedment length, clear cover, and bearing area on the behavior of high-strength anchor bolts were evaluated. Both model and full-scale tests were conducted. In addition, a series of exploratory fullscale tests were run to determine the influence of cyclic load, lateral load, bolt groups, and transverse reinforcement on the behavior. The tests showed that the anchor bolt transfers loads to the concrete member by a sequence involving steel-to-concrete bond, bearing against the washer of the anchorage device, and, finally, wedging action by a cone of crushed and compacted concrete in front of the anchorage device. GRA

N78-29279# Manca (Varlerie M.), Los Alamos, N. Mex.
PROCESSES OF PLASTIC DEFORMATION, THEIR CONDITIONS AND EFFECT ON THE PROPERTIES OF THE FINAL PRODUCT
I. M. Pavlov, G. N. Mekhed, and D. V. Sokolov 1977 17 p refs Transl. into ENGLISH from "Plasticheshkaia Deformatsiia Neriadmovyky Metallicheskikh Materialov" USSR, 1976 p 184-192 Prepared for LASL
(Contract W-7405-eng-36)
(LA-tr-77-68) Avail: NTIS HC A02/MF A01

A review is presented of the state of the manufacturing art for superconducting wires, ribbons, and conductors. Emphasis is on drawing techniques for small diameter wire using clad material to overcome the problem of fragility of the superconducting material. Author (ERA)

N78-29280# Sandia Labs., Albuquerque, N. Mex.
ULTRASONIC ATTENUATION AS A FUNCTION OF HEAT TREATMENT AND GRAIN SIZE IN 79Ni-6Mo-15Fe ALLOY
John H. Gieske Mar. 1978 20 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0144) Avail: NTIS HC A02/MF A01

A pulse echo ultrasonic technique was used to measure the attenuation coefficient for 79Ni-6Mo-15Fe alloy specimens. The attenuation coefficient was determined using a 25 MHz ultrasonic transducer for specimens which had undergone different time temperature heat treatments. The ultrasonic attenuation data versus heat treat time was used to assess grain size growth in the specimens. ERA

N78-29281# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
A TEMPERATURE CONTROLLED WATER BATH FOR VISCOSITY MEASUREMENT
Dorothy E. Ruffell Dec. 1977 15 p refs
(NPL-MOM-24) Avail: NTIS HC A02/MF A01

The construction and performance of a temperature controlled water bath designed and made at NPL for use with glass capillary viscometers is described. Tests on the bath demonstrate that it is capable of maintaining a selected temperature between 20 and 40 C to within + or - 0.01 C. Author (ESA)

N78-29282# West Virginia Univ., Morgantown. Dept. of Civil Engineering.
AN INVESTIGATION OF THE PARAMETERS INFLUENCING BOND BEHAVIOR WITH A VIEW TOWARDS ESTABLISHING DESIGN CRITERIA. VOLUME 1: MAIN REPORT Final Report
Emory L. Kemp, William J. Wilhelm, N. Jim Chen, and Roger B. Alke Nov. 1977 244 p refs Sponsored in part by Amer. Society of Civil Eng., New York. Reinforced Concrete Res. Council
(PB-279512/8; WVDOH-46-2-Vol-1; FHWA/WV-77/6-Vol-1)
Avail: NTIS HC A11/MF A01 CSCL 13C

Tests of one hundred and forty seven, two and three bar bond specimens are reported. These specimens represent the completion of WVDOH-RCRC Project 46. The entire study has used the specially designed W.Va University bond testing apparatus. The data are discussed in terms of the strength of the materials used, the specimen geometry and the type and quantity of web reinforcement. The lower bound equations for predicting the limiting bond stress and the development length required are presented in terms of bar diameter (which is the ratio of the bar cross-sectional to surface area), bar strength, concrete strength, web reinforcement and the cover and spacing of the bars. The W.V.U. recommended design equation for development length includes a consideration of dowel force and is compared to the University of Texas-Austin's recommended equation. A full set of bondship curves for all the specimens tested is included. GRA

N78-29283# West Virginia Univ., Morgantown. Dept. of Civil Engineering.
AN INVESTIGATION OF THE PARAMETERS INFLUENCING BOND BEHAVIOR WITH A VIEW TOWARDS ESTABLISHING DESIGN CRITERIA. VOLUME 2: APPENDIX Final Report
Emory L. Kemp, William J. Wilhelm, N. Jim Chen, and Roger B. Alke Nov. 1977 198 p Sponsored by Amer. Soc. of Civil Eng. New York. Reinforced Concrete Res. Council
(PB-279513/6; WVDOH-46-2-Vol-2; FHWA/WV-77/6-Vol-2)
Avail: NTIS HC A09/MF A01 CSCL 13C

The data are discussed in terms of the strength of the materials used, the specimen geometry and the type and quantity of web

reinforcement. The lower bound equations for predicting the limiting bond stress and the development length required are presented in terms of bar diameter (which is the ratio of the bar cross-sectional to surface area), bar strength, concrete strength, ratio of the bar crosssectional to surface area), bar strength, concrete strength, web reinforcement and the cover and spacing of the bars. The W.V.U. recommended design equation for development length includes a consideration of dowel force and is compared to the University of Texas-Austin's recommended equation. GRA

N78-29284# Transportation Research Board, Washington, D. C.
DESIGN AND PERFORMANCE OF PAVEMENT OVERLAYS
R. F. Carmichael, B. F. McCullough, W. H. Hudson, K. H. McGhee, and M. C. Wang 1977 54 p refs
(PB-279523/5; TRB/TRR-632; ISBN-0-309-02658-X) Avail: NTIS HC A04/MF A01 CSCL 13B

The following studies are presented: (1) analysis of an operational rigid pavement system for continuously reinforced concrete pavements; (2) an experiment for continuously reinforced concrete pavement in Walker County, Texas; (3) effectiveness of pressure relief joints in reinforced concrete pavements; (4) performance evaluation for bituminous concrete pavements at the Pennsylvania State Test Track; (5) design and performance of flexible pavements in the tropics; (6) road test to determine implications of preventing thermal reflection cracking in asphalt overlays; and (7) analytical modeling and field verification of thermal stresses in overlay. GRA

N78-29285# Virginia Highway and Transportation Research Council, Charlottesville.
THE APPLICABILITY OF INFRARED THERMOGRAPHY IN THE DETECTION OF DELAMINATION IN BRIDGE DECKS
Gerardo G. Clemena and Wallace T. McKeel, Jr. Dec. 1977 40 p refs
(PB-279508/6; VHTRC-78-R27; FHWA/VHTRC-78-R27) Avail: NTIS HC A03/MF A01 CSCL 13B

The use of infrared thermography to very accurately define variations in surface temperatures was evaluated as a means of identifying delaminated areas caused by corrosion of reinforcing steel in concrete bridge decks. It was found that because of the vast differences in the volumetric heats of the solid concrete and the air in the cracks around a delaminated area, the separated concrete was warmer when exposed to solar heating than was the adjacent sound material. Differences in the temperatures of the deck surface, shown in various shades or colors on a cathode ray tube, were photographed to provide a permanent graphic record of the location of the warmer, distressed areas. GRA

N78-29286# Material Systems Corp., Escondido, Calif.
A STUDY OF THE FEASIBILITY OF UTILIZING SOLID WASTES FOR BUILDING MATERIALS. PHASE 1, SUMMARY REPORT
B. L. Duft, H. Levine, and A. McLeod Apr. 1978 164 p
(Contract EPA-68-03-2056)
(PB-279440/2; EPA-600/2-78-091) Avail: NTIS HC A08/MF A01 CSCL 13B

A study to research and develop building materials containing organic and inorganic wastes and waste-derived products is reported. A comprehensive literature search was conducted to review and evaluate wastes with potential as matrices, reinforcements, or fillers in building composites. The most promising candidates were evaluated with limited laboratory studies. From these studies, two types of matrices, furfural-phenolic and inorganic, were selected for further study. Seven reinforcement candidates and five filler candidates were selected for evaluation with the two matrices. GRA

N78-29287# National Bureau of Standards, Washington, D. C. Office of Measurement Standards.
CALIBRATION AND RELATED MEASUREMENT SERVICES OF THE NATIONAL BUREAU OF STANDARDS
B. C. Belanger, ed. Apr. 1978 106 p refs Supersedes NBS-SP-250-1970
(PB-279459/2; NBS-SP-250-1978; LC-63-60099; NBS-SP-250-1970) Avail: NTIS HC A06/MF A01 CSCL 14B

This publication provides detailed descriptions of the currently available NBS calibration services, measurement assurance programs, and other measurement services. In addition, each section describing specific services contains references to additional publications giving even more detail about the measurements techniques and procedures used. This revised edition reflects the services available as of the fourth quarter of 1977. NBS Special Publication 250 was last issued in 1970. The Appendix to SP 250 is reviewed every six months (June and December). It lists current prices for the services described. GRA

N78-29288# American Society of Mechanical Engineers, New York.
ASME REPORT ON PIPELINE SYSTEM SAFETY Final Report
Mar. 1978 32 p refs
(PB-279330/5; ASME/GPT-1978/1) Avail: NTIS HC A03/MF A01 CSCL 13L

Work on a project to study the feasibility of the application of system safety to gas piping systems is summarized. Based on studies of selected facilities, it was concluded that system safety analysis could be applied to all phases of the design, construction, operation, and maintenance of a natural gas pipeline system. GRA

N78-29289# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.
DETAILED APPLICATION OF A TECHNOLOGY FOR THE FORMULATION AND EXPRESSION OF STANDARDS APPLICABLE TO THE AMERICAN NATIONAL STANDARD BUILDING CODE REQUIREMENTS FOR MINIMUM DESIGN LOADS IN BUILDINGS AND OTHER STRUCTURES (ANSI A58.1-1972) Final Report
L. K. Cunningham, J. W. Melin, and R. L. Tavis Jan. 1978 262 p refs
(Contract NBS-6-13980)
(PB-279091/3; UILU-ENG-78-2003; STRUCTURAL-RESEARCH-SER-446; NBS-GCR-78-123) Avail: NTIS HC A12/MF A01 CSCL 13M

This investigation applies decision-table and information-network technology in the analysis of the American National Standard Building Code Requirements for Minimum Design Loads in Building and Other Structures (ANSI A58.1-1972). Part 1 summarizes the logic and technology available for decision-table and information-network analysis. It also sets down a rationale for the attempt to apply this logic at the requisite level of detail and develops the concepts, policies, and procedures that enable such application. Part 2 applies the available technology to the ANSI Standard, and in a detailed commentary on each decision table and on the information network, sets down the questions raised by the analysis of each. GRA

N78-29290# National Bureau of Standards, Washington, D. C.
COMPUTER SCIENCE AND TECHNOLOGY: NBS/RIA ROBOTICS RESEARCH WORKSHOP PROCEEDINGS
John M. Evans, Jr. 1977 43 p refs Workshop held at Williamsburg, Va., 12-13 Jul. 1977 Prepared in cooperation with the Robot Inst. of America, Dearborn, Mich.
(PB-279334/7; NBS-SP-500-29) Avail: NTIS HC A03/MF A01 CSCL 13I

The NSB/RIA Robotics Research Workshop had two objectives: (1) to provide a forum for structured discussions between researchers in robotics and manufacturers and users of robot systems; and (2) to develop a consensus forecast of future developments in sensors and control systems for industrial robots. The two day Workshop brought together 31 researchers, manufacturers, and users of industrial robots in order to determine the needs and priorities for future research in sensors and control techniques for industrial robots. There were no formal papers; instead, small group discussions and presentations and the preparation of a Delphi Forecast were used to address research needs and priorities. GRA

N78-29291# California State Dept. of Transportation, Sacramento. Transportation Lab.
ANALYSIS OF FULL DEPTH AC PAVEMENTS USING

LAYERED ELASTIC THEORY Final Report
Robert N. Doty and Gary W. Mann Jun. 1977 96 p refs Sponsored in part by Federal Highway Admin.
(PB-279386/7; FHWA/CA/TL-3489-77-13; Rept-633489) Avail: NTIS HC A05/MF A01 CSCL 13B

Full depth AC pavements constructed near Indio, Blythe, and Willits, California, were instrumented during construction and subsequently tested, using slow speed loads, to measure in-situ stress, strain, and deflection. In-situ pavement temperatures and subgrade moisture contents were also measured. An interim report describing the components and procedures used for this instrumentation was published in 1973. The data have now been used to evaluate a theoretical pavement analysis procedure incorporating layered elastic theory that was under consideration as an addition to the Caltrans structural section design procedure. Due to the questionable validity of the in-situ measurements, the accuracy of the layered elastic theory approach studied could not be conclusively determined. It was concluded that the apparent instrumentation difficulties encountered will have to be overcome before a conclusive evaluation of the layered elastic theory approach can be completed. GRA

N78-29292# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
VIBRATION OF UNREINFORCED PAVEMENT CONCRETE Final Report
Richard G. Phillips Mar. 1978 15 p ref Sponsored by DOT (PB-279148/1; RR-78-59; FHWA-NY-78-RR-59) Avail: NTIS HC A02/MF A01 CSCL 13B

The interim report for this research project indicated that a substantial amount of vibration is transmitted to pavement concrete by the mesh and mesh depressors. When plain (unreinforced) pavements were specified, concern arose over the possibility of insufficient consolidation. The Department thus instructed contractors to install three additional spud vibrators on their finishing machines. To check consolidation on a contract with plain pavement, cores were extracted at known distances from any spud vibrator. Density and entrapped air measurements on these cores agree with the findings of the earlier report. Adequate consolidation was achieved without the mesh and depressors, and no segregation of aggregate nor increase in entrapped air was found. Further, the additional three vibrators in a 24-ft width specified by the Department are not considered necessary. GRA

N78-29293# Maine Dept. of Transportation, Augusta.
DEICING-CHEMICAL RATES ON OPEN-GRADED PAVEMENTS: STUDIES IN MAINE, MICHIGAN, UTAH, AND VERMONT Final Report
William C. Besselievre Sep. 1977 37 p Prepared in cooperation with Michigan Dept. of State Highways and Transportation, Utah Dept. of Transportation, and Vermont Dept. of Highways
(Contract DOT-FH-11-9212)
(PB-279224/0; FHWA/TS-77/216) Avail: NTIS HC A03/MF A01 CSCL 13B

During the 1976-1977 winter season, the Federal Highway Administration sponsored four studies which were designed to determine if more salt (sodium chloride) is needed to clear open-graded asphalt friction courses during winter storms than is needed to clear conventional pavements. This report summarizes each of the States' findings and describes the prevailing behavior of all open-graded pavement sections observed by the four States. An analysis of recorded data, photographs and comments from the four States supports the view that more salt is not needed to clear opengraded pavements. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-29294 Utah Univ., Salt Lake City.
AN INVESTIGATION OF THE GROWTH AND DECAY OF LONG AND SYNOPTIC-SCALE WAVES Ph.D. Thesis
Chun-Nan Chi 1978 124 p
Avail: Univ. Microfilms Order No. 7809961

The growth and decay of the kinetic and the available potential energy are investigated through the application of Fourier analysis of the observational data on the mid-latitude. The data extracted are velocities and temperature of the winter season 1975 of the Northern Hemisphere. For comparison, two computational methods have been applied, namely, the composite and the periodic methods. The results of both methods consistently show that the evolution of kinetic energy of various wavenumbers are essentially contributed by the nonlinear energy transfers, while those of the available potential energy are mainly due to the back and forth energy transfers between thermal and velocity waves, as well as the excitation of the north-south temperature gradient. Dissert. Abstr.

N78-29295 California Univ., Los Angeles.
HIERARCHICAL ORGANIZATION OF DISTRIBUTED PACKET-SWITCHING COMMUNICATION SYSTEMS Ph.D. Thesis
Gideon Yoseph Akavia 1978 340 p
Avail: Univ. Microfilms Order No. 7811328

Both dedicated channels and ALOHA are bad when the traffic is of medium burstinessj Mixed-mode systems, using ALOHA in the bottom level and dedicated channels in the top level will then be good. Mixed-mode networks trade the amount of interference in the random access level against the number of dedicated channels in the top level. By choosing the right mix these networks adjust themselves so that they are insensitive to the limits of each level's access scheme. Dissert. Abstr.

N78-29296 Columbia Univ., New York.
AN ASSIGNED-SLOT LISTEN-BEFORE-TRANSMISSION PROTOCOL FOR A MULTIACCESS DATA CHANNEL Ph.D. Thesis
Lynn Warren Hansen 1978 302 p
Avail: Univ. Microfilms Order No. 78-11136

A multiaccess data channel is one which is shared by many geographically distributed users, and may use radio or wire as its transmission medium. The concept of a slot assignment wherein each user is allowed to offer messages to the channel only at specific times is introduced. In particular, a new listen-before-transmission protocol is presented where each of N users is assigned one slop per time frame of L slots in which to listen to the channel to see if it is busy or not. The primary thrust of this dissertation is the analysis of the new protocol, and its comparison with other schemes of current interest. Throughput-delay tradeoffs are derived and a stability analysis made, and possible means of stability control are explored. Dissert. Abstr.

N78-29297 New Orleans Univ., La.
CAUSALITY AND THE PROPAGATION OF RELATIVISTIC FIELDS Ph.D. Thesis
James Loris Robinett, Jr. 1977 59 p
Avail: Univ. Microfilms Order No. 78-09781

The propagation of a field satisfying a typical relativistic field equation is investigated in order to determine the causal relations implicitly defined by that propagation. For a typical relativistic field it is found that a uniqueness theorem associated with Cauchy's initial value problem places an upper limit on the speed of propagation. This is necessary for the existence of a causal order relation between pairs of events in spacetime. It is shown that for any complex value of the mass the speed of light is an upper limit on the speed of propagation of the field and that a Lorentz invariant causal order relation exists. The role of Lorentz invariance in the propagation of more general relativistic fields is discussed. Dissert. Abstr.

N78-29298 British Library Lending Div., Boston Spa (England).
IMPAIRMENT OF PICTURE SIGNALS AND SUBJECTIVE QUALITY IN DIGITAL CODING: EDGE BUSINESS VISIBILITY
F. Kretz and J. L. Boudeville 8 Sep. 1977 48 p refs Transl. into ENGLISH from Ann. Telecommun. (France), vol. 31, no. 7-8, Sep. - Oct. 1976 p 333-356
(BLL-PO-Trans-3516-(7737.47)) Avail: British Library Lending

Div., Boston Spa, Engl.

A discussion on the impairment of picture signals in digital coding is presented. Emphasis is placed on perception of impairment through psychovisual tests. G.Y.

N78-29299 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF TRANSMISSION SYSTEMS ON SUBJECTIVE PICTURE QUALITY
Hannelore Sulanke and Heinz Dobesch 3 Feb. 1978 10 p refs Transl. into ENGLISH from Tech. Mitt. RFZ (West Germany), vol. 21, no. 1, 1977 p 11-13
(BLL-PO-Trans-3541-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The case of several video channel parameters were studied to determine practical methods for calculating the influences of transmission systems on picture quality. Mathematical models, and approximate calculations of the subjective quality of transmission systems are presented. F.O.S.

N78-29300 Japan Broadcasting Corp., Tokyo. Program Engineering Research Group.
GHOST ANALYZER FOR MEASURING TV GHOST WAVES
Hiroshi Miyazawa and Yukio Endo Mar. 1978 12 p
(NHK-Labs-Note-223) Copyright. Avail: Issuing Activity

The ghost image in television reception, like other electrical noise interferences, is a major factor which determines television reception environments. For analysis of ghost signals to reduce ghost troubles, an equipment, which is called a ghost analyzer was developed. The method used to estimate the degree of interference (ghost) was that of observation and measurement of the demodulated output signal waveform of received waves, which is widely used in the field. Through testing it was found that a ghost analyzer capable of measuring ghost signals up to 35 db in a D/U ration was required. G.Y.

N78-29301 Stanford Univ., Calif.
FACSIMILE COMMUNICATION AND ELECTRONIC MAIL SYSTEM BY SATELLITE IN IRAN AND OTHER DEVELOPING NATIONS Ph.D. Thesis
Mohammad-Reza Eftekhari 1978 350 p
Avail: Univ. Microfilms Order No. 7808785

The advantages of satellite telecommunication for electronic mail and national facsimile newspaper distribution are considered. Statistical models were developed to project total mail volume and to estimate mail flow between cities based on literacy, economic growth, and population. Technical specifications of an electronic mail system, along with various proposed service descriptions, are given. Multiple access techniques for the electronic transfer of mail among various post offices, especially time division multiple access (TDMA), are discussed and analyzed. It is seen that electronic transfer of mail data results in significant reduction in delivery time and reduces the handling cost of mail. National newspaper distribution is currently growing for many developing nations such as Iran. When this is done by communication satellite, broadcasting facsimile copies of the paper from the central editorial office to the decentralized press locations will reduce the distribution time by one to two days, and will result in a very small incremental cost to the system.
Dissert. Abstr.

N78-29302*# Houston Univ., Tex. Dept. of Electrical Engineering.
ULTRASONIC SIMULATION OF MSBLS MULTIPATH FADING FOR ORBITER LANDING CONFIGURATION Final Report
H. S. Hayre 28 Feb. 1978 87 p refs
(Contract NAS9-11845)
(NASA-CR-151752) Avail: NTIS HC A05/MF A01 CSCL 20N

The on-shuttle antenna pattern of the MSBLS receiver, and the azimuth and elevation beamwidths were simulated by their corresponding ultrasonic transducer beams. The scanning rate for the azimuth and elevation beams was 1.75 degrees/second. The results were adjusted for full-scale maximum sinusoidal scan rates of 691 and 377 deg/sec for AZ and EL respectively. The rain drops were simulated by air bubbles, with a similar size distribution, in water. The rain volume was created along a part of the propagation path, and not on the runway, because it was found difficult to avoid an accumulation of bubbles on the runway surface and surroundings simulated by the model surface. Multipath fading from the ground, and its possible degrading effect on the orbiter received beam shape and the associated landing guidance parameters is discussed. A.R.H.

N78-29303*# California Univ., Berkeley. College of Engineering.
RESEARCH OF MICROWAVE SCATTERING PROPERTIES OF SNOW FIELDS Final Technical Report, 1 Feb. 1976 - 31 Jul. 1978
D. J. Angelakos Aug. 1978 32 p refs
(Grant NsG-5093)
(NASA-CR-157472) Avail: NTIS HC A03/MF A01 CSCL 20N

The results obtained in the research program of microwave scattering properties of snow fields are presented. Experimental results are presented showing backscatter dependence on frequency (5.8-8.0 GHz), angle of incidence (0-60 degrees), snow wetness (time of day), and frequency modulation (0-500 MHz). Theoretical studies are being made of the inverse scattering problem yielding some preliminary results concerning the determination of the dielectric constant of the snow layer. The experimental results lead to the following conclusions: snow layering affects backscatter, layer response is significant up to 45 degrees of incidence, wetness modifies snow layer effects, frequency modulation masks the layer response, and for the proper choice of probing frequency and for nominal snow depths, it appears to be possible to measure the effective dielectric constant and the corresponding water content of a snow pack. F.O.S.

N78-29304*# Hughes Aircraft Co., Culver City, Calif. Radar Systems Group.
ADVANCED MICROWAVE RADIOMETER ANTENNA SYSTEM STUDY Final Report, Sep. 1974 - Jan. 1976
W. H. Kummer, A. T. Villeneuve, and A. F. Seaton Aug. 1976 143 p refs
(Contract NAS5-20738)
(NASA-CR-156776; P76-429; HAC-Ref-D2444) Avail: NTIS HC A07/MF A01 CSCL 20N

The practicability of a multi-frequency antenna for spaceborne microwave radiometers was considered in detail. The program consisted of a comparative study of various antenna systems, both mechanically and electronically scanned, in relation to specified design goals and desired system performance. The study involved several distinct tasks: definition of candidate antennas that are lightweight and that, at the specified frequencies of 5, 10, 18, 22, and 36 GHz, can provide conical scanning, dual linear polarization, and simultaneous multiple frequency operation; examination of various feed systems and phase-shifting techniques; detailed analysis of several key performance parameters such as beam efficiency, sidelobe level, and antenna beam footprint size; and conception of an antenna/feed system that could meet the design goals. Candidate antennas examined include phased arrays, lenses, and optical reflector systems. Mechanical, electrical, and performance characteristics of the various systems were tabulated for ease of comparison. Author

N78-29305# Council for Scientific and Industrial Research, Pretoria (South Africa).
THE DESIGN OF ALL-PASSES, LOW-PASSES AND BAND-PASSES WITH A CONSTANT GROUP DELAY APPROXIMATED ACCORDING TO CHEBISHEV
E. Ulbrich and H. Piloty 1978 46 p refs Transl. into ENGLISH from A.E.Ve. (West Germany), v. 14, no. 10, 1960 p 451-467
(CSIR-Trans-1402) Avail: NTIS HC A03/MF A01

A general and conclusive method for approximation of a constant group delay suitable for digital computers is proposed. The most significant theoretical principles for the synthesis of all-passes are listed and the properties of the delay functions are investigated. The utilization of rational functions for solving the problem is presented. A review on practically performed and tabulated approximations as well as general views resulting from there are given. The design for a special example of a higher degree is carried out practically in detail and the realizing circuit is described. A general summary is given along with a brief description of the possibility of an explicit solution of the problem. G.Y.

N78-29306*# Westinghouse Electric Corp., Baltimore, Md.
COMMUNICATIONS LINK CHARACTERIZATION EXPERIMENT (CLCE), VOLUME 3
Aug. 1977 95 p refs
(Contract NAS5-20729)
(NASA-CR-156801; FIS-77-4057-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 17B

The results of data which were acquired, reduced and analyzed as of June 1977, from the Communications Link Characterization Experiment while utilizing the Communications Link Characterization Experiment while utilizing the Communications Technology Satellite is presented. The long term yearly and worst month propagation data from both stations are presented for the defined yearly period and the test results of the Goddard Television Experiment are described. The data for the continuing path length analysis are updated. Progress on the continuing analysis of utilizing the weather radars for attenuation prediction is given and the concept of the weather radar ratio is presented. L.S.

N78-29307*# Ohio State Univ., Columbus. ElectroScience Lab.
AMPLITUDE SCINTILLATIONS ON EARTH-SPACE PROPAGATION PATHS AT 2 AND 30 GHz M.S. Thesis
D. M. J. Devasirvatham and D. B. Hodge Mar. 1977 101 p refs
(Contract NAS5-22575)
(NASA-CR-156785; ESL-4299-4) Avail: NTIS HC A06/MF A01 CSCL 20N

Amplitude scintillation measurements were made simultaneously at 2.075 and 30 GHz on earth-space propagation paths over elevation angles in the range 0.4 to 44 deg. The experiment was performed as the Applications Technology Satellite (ATS-6) was moved slowly from a synchronous position over Africa to a new synchronous position over the United States. The received signal, variance, level, covariance, spectra and fade distributions are discussed as functions of the path elevation angle. These results are also compared wherever possible with similar measurements made earlier at 20 and 30 GHz. Author

N78-29308*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
COMMUNICATIONS LINK CHARACTERIZATION EXPERIMENT (CLCE)
Jan. 1977 108 p refs Original contains color illustrations
(Contract NAS5-20729)
(NASA-CR-156784; FIS-76-4039A) Avail: NTIS HC A06/MF A01 CSCL 17B

Results of the data which were acquired, reduced, and analyzed from the Communications Link Characterization Experiment (CLCE) while utilizing the CTS satellite are presented. The test data obtained from the stations consisted of the results of various TV tests, attenuation and rain rate data. An additional meteorological parameter was measured and it consists of the back scatter returns of the multifrequency weather radar. B.B.

N78-29309*# ORI, Inc., Silver Spring, Md.
A COMPENDIUM OF MILLIMETER WAVE PROPAGATION STUDIES PERFORMED BY NASA Final Report, 29 Jul. - 31 Dec. 1977
Roger Kaul, David Rogers, and James Bremer Dec. 1977 119 p refs
(Contract NAS5-24252)
(NASA-CR-156781) Avail: NTIS HC A06/MF A01 CSCL 20N

Key millimeter wave propagation experiments and analytical results were summarized. The experiments were performed with the Ats-5, Ats-6 and Comstar satellites, radars, radiometers and rain gage networks. Analytic models were developed for extrapolation of experimental results to frequencies, locations, and communications systems. B.B.

N78-29310*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROSTRIP BACK-FIRE ANTENNA Patent Application
Thomas G. Campbell and Norman V. Cohen, inventors (to NASA) (Old Dominion University Norfolk, Va.) Filed 26 Jul. 1978 8 p
(NASA-Case-LAR-12172-1; US-Patent-Appl-SN-928132) Avail: NTIS HC A02/MF A01 CSCL 20N

A backfire antenna that is fed by a rectangular microstrip resonator is presented. The microstrip resonator is either flush mounted with, or mounted in front of the large, circular reflector of the backfire antenna. The small reflector of the backfire antenna can be either rectangular or circular in shape and is positioned in front of the rectangular resonator at a spacing of about 0.35 wavelengths of the operating frequency. For excellent gain the rectangular microstrip resonator is 0.5 wavelength by 1.5 wavelength (in the dielectric material), the small rectangular reflector is 0.4 wavelength by 0.9 wavelength and the small circular reflector is 0.4 wavelength in diameter. The electrical dimensions for all of the reflectors used are expressed in wavelengths in free space. NASA

N78-29311# Royal Aircraft Establishment, Farnborough (England).
THE RIAR SYSTEM, A NEW TELECOMMUNICATION SYSTEM. HIGH-ALTITUDE, ARTIFICIALLY-IONISED REGIONS. POSSIBLE EXTENSION TO VHF, UHF AND SHF TELECOMMUNICATION
A. L. Rorive Mar. 1978 19 p refs Transl. into ENGLISH from Rev. Offic. de la Federation des Ingr. des Telecommunications de la Communaute Europeenne (France), No. 4, Jul.-Aug. 1976 19 p
(RAE-Lib-Trans-1968; BR63522) Avail: NTIS HC A02/MF A01

The artificially ionized reflector system for telecommunications uses the unconfined plasma in the high upper atmosphere for transmission and diffusion of VHF and UHF electromagnetic waves within the framework of established allocations. The system is applicable to television and sound radio diffusion services, point-to-point transmission services, security service networks, scientific networks, and to military communications. The new process uses a controlled, reflecting layer for frequency and channel distributions in regard to existing bands which are not yet fully utilized. G.G.

N78-29312# E-Systems, Inc., St. Petersburg, Fla.
DIGITAL COMMUNICATIONS/INTEROPERABILITY TECHNIQUES Final Report, Jun. 1973 - Sep. 1977
Peter Zakanycz (Communications Research and Development Command, Fort Monmouth, New Jersey) and William L. Betts Feb. 1978 31 p refs
(Contract DAAB07-73-C-0304)
(AD-A053558; ECOM-73-0304-F) Avail: NTIS HC A03/MF A01 CSCL 17/2

Contemporary long haul and tactical digital communications systems employ a variety of digital transmission formats. New code conversion equipment has been developed which digitally converts between different pulse code modulation formats and between pulse code modulation formats and delta modulation formats. Conversion is accomplished on wideband trunks without restoring the signal to analog baseband. The digital code conversion techniques may be applied to conventional multiplex equipment, Army tactical communications equipment, strategic communications systems, and TRI-TAC equipment. Conversions are accomplished with respect to data format, data rate, supervision and signaling formats and electrical interface. The code conversion techniques promise significant advantages in utility, performance and cost. System applications of the digital code converter are compared with other alternatives. Signal-to-quantization noise ratio measurements on channels which have undergone digital code conversion are presented. Author (GRA)

N78-29313# Computer Sciences Corp., Falls Church, Va.
CONSIDERATIONS FOR A SMALL ECONOMICAL EARTH TERMINAL Final Report
William B. Munson 20 Jan. 1978 76 p refs
(Contract DCA100-76-C-0089)
(AD-A053623; AD-E100049) Avail: NTIS HC A04/MF A01 CSCL 17/2

A small economical earth terminal which could be used in the Defense Satellite Communications System (DSCS) in the early 1980's is described. This terminal would be small, relatively inexpensive ($250,000), would stress fixed-plant location and unattended operation, and would be designed to support low-data-rate users. A network of such terminals, controlled by

a larger network control terminal, is postulated. Communications links between terminals in this network would be established on a demand-assigned, single-channel-per-carrier basis. Basic technical parameters of the terminal are derived based on system considerations. A G/T of 22 db and an EIRP of 72 dBW are proposed. Support and acquisition requirements are also considered as a means of reducing costs. It is emphasized that judicious application of support and acquisition requirements is essential to achieve the desired cost constraints. It is concluded that the concept of a small economical earth terminal is feasible for use in the DSCS and could be procured in production quantities of 100 terminals within the cost constraints described.
Author (GRA)

N78-29314# Office of Naval Research, London (England).
RADAR-77
D. A. Hart 2 Dec. 1977 26 p Conf. held at London, 25-28 Oct. 1977; sponsored in part by Inst. of Elec. Engr. and IEEE Aerospace and Electron. Systems Soc.
(AD-A053624; ONRL-C-18-77) Avail: NTIS HC A03/MF A01 CSCL 17/9

The Institution of Electrical Engineers and the IEEE Aerospace and Electronic Systems Society organized a major four day international conference, Radar-77, held in London 25-28 October 1977. A brief description of some of the papers presented at this conference is presented. A complete list of the papers at Radar 77 is included as an appendix. Author (GRA)

N78-29315# Ohio State Univ., Columbus. ElectroScience Lab.
RADAM PHENOMENA OF TRACKED VEHICLES Interim Report
C. W. Chung Mar. 1978 19 p ref
(Grant AF-AFOSR-2611-74; AF Proj. 2304)
(AD-A053634; ESL-3815-5; AFOSR-78-0735TR) Avail: NTIS HC A02/MF A01 CSCL 17/9

The backscatter power density spectrum from the track of a tracked vehicle is investigated in this report. The major contributors to the spectrum are modeled as a rotating cylinder and a uniformly moving linear array. Both spectra consist of discrete spectral lines. The former peaks around the incident angular frequency omega sub 0, while the latter peaks around (omega sub 0 -(omega sub D)(cos psi), where omega sub D is the Doppler angular frequency and psi is the angle of incidence measured from the direction of the array velocity. Author (GRA)

N78-29316# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
QUANTITATIVE PROCESSING OF SIGNAL SPACE DATA TO PROVIDE TRANSMISSION LINE ANALYSIS M.S. Thesis
Robert A. Mintonye Dec. 1977 135 p refs
(AD-A053444; AFIT/GE/EE/77-28) Avail: NTIS HC A07/MF A01 CSCL 17/2

Quantitative processing of signal space data to provide transmission line analysis was developed in support of work being done at the USAF Rome Air Development Center Laboratories. The RADC engineers were working with digital modems and they were qualitatively analyzing transmission line perturbations through observation of an oscilloscope display of the signal space representation. The display was being generated by an optional circuit available with the modem, but the oscilloscope display was not capable of providing adequate quantitative perturbation information. However, the signal space data did contain all of the information required for a complete quantivative analysis of the transmission line perturbations. Therefore, a system using the same data potentially could be devised to perform the analysis. A signal space data analysis system design was developed in this thesis, which would be capable of providing three displays of the signal space representation, the amplitude and phase deviations, and the frequency spectrum of the phase deviations or phase jitter. The system would consist of the digital modem, a minicomputer, and an interface device between the modem and minicomputer which would be capable of interrupting the minicomputer. A FORTRAN program was also developed and run in a simulation effort which transformed the xy data of the signal space into a form of data which could be plotted on the three displays. Though the system was not actually constructed, it was successfully simulated such that it would merit implementation. Author (GRA)

N78-29317# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
ROBUST PARAMETER ESTIMATORS FOR COMMUNICATION DATA Annual Report
P. Papantoni-Kazakos 3 Dec. 1977 71 p refs
(Grant AF-AFOSR-3156-77; AF Proj. 2304)
(AD-A053901; AFOSR-78-0777TR) Avail: NTIS HC A04/MF A01 CSCL 09/4

The object of this grant is the analysis and design of decision procedures that have stable, good performance in statistically ill-defined environments. Such procedures indicate the way to design powerful receivers for systems whose statistical behavior cannot be described precisely (due to incomplete availability of data about the system behavior). Different distance measures have been studied for use as performance criteria for robust estimates. Careful evaluation and comparison of these distances was done and their similarities, advantages and disadvantages were carefully stated. A feature selection problem was studied, when several distance measures are used as discrimination criteria. A sequential procedure for clustered data was proposed and analyzed. Hampel's general qualitative definition of robustness of sequences of estimators on memoryless observation processes was generalized to stationary processes. The constructive analysis of robustness completed by the author is being used now in the performance analysis of communication networks at Bell Laboratories. Author (GRA)

N78-29318# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
THE USE OF REDUNDANT PACKETS IN SLOTTED-ALOHA-TYPE RADCOM-ACCESS SYSTEMS
James L. Massey Mar. 1978 7 p refs
(Contract N00014-64-C-1183; ARPA Order 3045)
(AD-A053737; ESL-P-809) Avail: NTIS HC A02/MF A01 CSCL 17/2

Slotted-Aloha-type systems are considered in which each transmission is a super-packet consisting of several data packets and some redundant packets in a fixed temporal pattern. Two results are obtained. The first, a negative result, shows that such redundancy, no matter how cleverly exploited, cannot increase the system throughput above that for irredundant transmissions. The second, a positive result, shows that, when the temporal pattern is determined by a simple difference set, average data packet delay can be reduced over an interesting range of throughput values. Author (GRA)

N78-29319# CNR, Inc., Needham, Mass.
DEMOD/DECODER INTEGRATION Final Technical Report, Jul. 1976 - Sep. 1977
D. Chase, L. J. Weng, P. A. Bello, A. Joffe, and R. Pinto Griffiss AFB, N.Y. RADC Apr. 1978 356 p refs
(Contract F30602-76-C-0361; AF Proj. 4519)
(AD-A053685; RADC-TR-78-70) Avail: NTIS HC A16/MF A01 CSCL 17/2

This report considers the benefits to be gained by an integrated coding and modulation approach for high speed digital communications over line-of-sight (LOS) and troposcatter links. While the importance of coding on tropo links has been previously established, this work indicates that error correction coding also plays an important role in the design of high bit packing density LOS modems. This result was not known a priori and, in fact, conventional rate-1/2 codes were shown to be ineffective for LOS modems operating with packing densities in excess of 2 bits/sec/Hz. However, an efficient 2 bits/sec/Hz and a 4 bits/sec/Hz modem, utilizing a rate-8/9 block code, were shown to yield superior performance to uncoded modems at this same packing density. GRA

N78-29320# White Sands Missile Range, N.Mex. Instrumentation Directorate.
CONCEPTS IN REAL-TIME VIDEO TRACKING Final Report, Sep. 1977 - Mar. 1978
A. L. Gilbert and M. K. Giles May 1978 90 p refs
(DA Proj. 1T6-65804-DE-93)
(AD-A054475; STEWS-ID-78-1) Avail: NTIS

HC A05/MF A01 CSCL 17/8

This report describes the real-time video (RTV) tracking system which will be deployed at the White Sands Missile Range (WSMR) during fiscal year 1979. This tracking system utilizes a distributive array of the five high-speed microprocessors to implement a real-time tracking algorithm with sufficient intelligence to overcome the tracking problems associated with typical noisy and cluttered backgrounds encountered in WSMR tracking imagery. Target positions relative to boresight and target attitude angles are also computed and recorded for each video field during the tracking sequence, thus eliminating the cost and delay imposed by present systems which require post-flight processing of film to extract these parameters. A computer simulation of the RTV tracking system has been developed at WSMR to test the tracking and image processing algorithms utilized in the system. The simulation program is described, along with other research tools developed as part of the WSMR image processing laboratory. Finally, significant results of an investigation of various image processing techniques suitable for RTV tracking are presented. Author (GRA)

N78-29321# Ford Aerospace and Communications Corp., Palo Alto, Calif.

SKYNET SGEMP TEST PROGRAM: THE SKYNET SATELLITE AS TEST OBJECT

Donald R. McMorrow Dec. 1977 49 p refs

(Contract DNA001-75-C-0035)

(AD-A054359; AD-E300204; DNA-4452T) Avail: NTIS HC A03/MF A01 CSCL 22/2

In 1974, the residual SKYNET I qualification model satellite became the keystone 'real satellite' analytical and test speciment in the DNA-Sponsored satellite SGEMP investigation program. Ford Aerospace provided the satellite, plus detailed information on the design and fabrication and assembly methods to co-contractors IRT, Mission Research Corporation (MRC), the Army Harry Diamond Laboratories (HDL), and Pulsar Associates. Such details were used in a three-pronged effort: (1) IRT used the design details to establish computer code models of SKYNET, and these codes were used to predict SKYNET's SGEMP response; (2) HDL conducted current-injection tests to establish the structural and cable response characteristics; (3) low-energy X-ray irradiation of the satellite was conducted by MRC and IRT to: (a) validate the assumption that 'tin-can' models can be effectively used to represent a real satellite for establishing satellite response; (b) demonstrate that the essential satellite response measurements can be made on an isolated satellite within a reasonable vacuum chamber; and (c) obtain the electromagnetic response of the satellite resulting from spacecraft charging. GRA

N78-29322# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

TRADEOFF OF HARDWARE AND SIGNAL-TO-NOISE RATIO IN MOVING TARGET INDICATORS

Jerry D. Moore (Computer Sciences Corp., Huntsville, Ala.) and Neal B. Lawrence 1 Mar. 1978 35 p refs

(DA Proj. 1M3-62303-A-214)

(AD-A054727; DRDMI-T-78-39) Avail: NTIS HC A03/MF A01 CSCL 17/9

In this report, the hardware requirement for various implementations of moving and fixed window moving target indicator is discussed and compared. The signal-to-noise improvement obtained by integration of moving target indicator outputs is calculated by analytical and simulation techniques for both configurations. It is demonstrated that the moving window moving target indicator produces correlation of noise samples where it is not present in fixed-window moving target indicator systems. It is shown that a square-law detector or a linear detector does not alter the relative performance of the moving and fixed window moving target indicator systems. A tabular result that compares hardware requirements (i.e., memories, adders, multiplexers, multipliers, multiplication speed) for the moving and fixed window moving target indicator is given. GRA

N78-29323# Systems Exploration, Inc., San Diego, Calif.

HF CHANNEL SIMULATOR FOR WIDE BAND SIGNALS. A MATHEMATICAL MODEL AND COMPUTER PROGRAM FOR 100-kHz BANDWIDTH HF CHANNELS Final Report, Feb. - Oct. 1977

R. Lugannani, H. C. Booker, and L. E. Hoff Mar. 1978 102 p (Contract N00123-76-C-1090)

(AD-A054726; NOSC-TR-208) Avail: NTIS HC A06/MF A01 CSCL 17/2

A simulator has been developed that is capable of modeling the wideband HF channel. It is designed for carrier frequencies in the 2-32 MHz range and it can accommodate bandwidths up to 100 kHz and ground ranges up to 1000 km. It models the groundwave and ionosphere returns. The inputs are the basic physical quantities that characterize the ionosphere (height, thickness, and maximum electron density of the E and F regions, sunspot number, time of day, etc) and those quantities that characterize the transmitter-receiver environment (carrier frequency, range, geographic location, antenna patterns, etc). Explicit values for channel parameters such as delay, attenuation, and Doppler shift and spread are not required as these are calculated internally. The simulator is divided into two parts. The first part is concerned with the mathematical model of the ionosphere and the computation of the channel parameters from the basic inputs. These channel parameters are used in the second part to determine the response for arbitrary inputs. A software version of the simulator has been implemented and tested, and a FORTRAN listing of the program is appended. The program runs in non-real time and requires a computer with a FORTRAN IV compiler and at least 28 K of core. Author (GRA)

N78-29324# Mission Research Corp., Santa Barbara, Calif.

PROPAGATION OF MICROWAVE SATELLITE COMMUNICATION SIGNALS THROUGH STRIATED MEDIA Topical Report, Nov. 1975 - Sep. 1977

Roy W. Hendrick, Jr. Sep. 1977 78 p refs

(Contract DNA001-76-C-0135)

(AD-A054677; MRC-R-334; DNA-4412T) Avail: NTIS HC A05/MF A01 CSCL 20/14

A series of multiple phase screen computations covered frequencies from 300 MHz to 9 GHz, rms electron concentration fluctuations from 10,000 to 10,000,000 electrons/cc for layers 150 km and 500 km thick at mean ranges of 300 and 1000 km respectively. The integrated phase shift irregularities were characterized by both exponential and inverse cube power spectral density functions with various characteristic lengths. When fading (scintillation) was significant, the important, low amplitude portion of the receiver signal is nearly Rician. The phase screen perturbations that are associated with structure of spatial wavelengths less than pie lf (lf is the Fresnel distance) are those responsible for the multipath scintillations. The field strength decorrelation distance in the receiver plane is approximately 1.414 times the reciprocal of the rms transverse derivative of phase in the phase screens when scintillation is significant. Author (GRA)

N78-29325# Arinc Research Corp., Annapolis, Md.

SHF TERMINAL/ANTENNA STUDY, TASKS 7 AND 8 Final Report

J. H. Witt and S. H. Kowalski Apr. 1978 43 p refs

(Contract F04701-77-C-0152)

(AD-A054703; Rept-1338-01-2-1736) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report defines the characteristics of the interface equipment necessary for the ABCC aircraft to relay secure voice communications between tactical elements in a crisis scene and AUTOSEVOCOM I subscribers via satellite using SHF transmissions. It also describes objectives to be demonstrated through tests of the recommended interface equipment. Three general design questions were considered: Where should the interface be located. How should the control function be accomplished. How should the multichannel requirements be met. Several alternative approaches were defined and assessed, and a recommended approach was selected and the associated interface equipment characteristics defined. Possible extensions of the recommended approach to provide capabilities beyond those of SHF relay were also considered. The report specifies laboratory of flight test objectives to verify and demonstrate the interface equipment operational SHF crisis scene relay capabilities, presents the principal conclusions resulting from the study, and recommends specific further actions. Author (GRA)

N78-29326# Lincoln Lab., Mass. Inst. of Tech., Lexington.

BANDWIDTH LIMITATIONS ON ACHIEVABLE CANCELLA-

TION FOR ADAPTIVE NULLING SYSTEMS
Joseph T. Mayhan 17 Feb. 1978 8 p refs
(Contract F19628-78-C-0002)
(AD-A054160; TN-1978-1; ESD-TR-78-25) Avail: NTIS HC A02/MF A01 CSCL 09/5

This technical note examines in detail the various limitations which influence the amount of cancellation achievable for a closed-loop type adaptive nulling system operating over a non-zero bandwidth. These limitations are categorized according to antenna limitations, and post-antenna channel tracking limitations. The former tend to be RF percentage bandwidth limited and the latter on the achievable component tolerances used to implement the channel (whether at RF or a lower IF). Both of these factors, and their influence on the nulling bandwidth, are examined in detail. Measured results are also presented for a seven-beam paraboloid-reflector type multiple-beam antenna (MBA), and the effects of feed-reflector multipath inherent in this geometry on the cancellation bandwidth is evaluated in detail. Author (GRA)

N78-29327# ITT Aerospace/Optical Div., Fort Wayne, Ind.
VEHICULAR INTERCOMMUNICATIONS SYSTEM
J. Heitz and J. McChesney Jan. 1978 61 p
(Contract DAAB07-77-C-0189)
(AD-A054021; ITT-A/OD-81100-TR-1; ECOM-77-0189-1-A; QR-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This is the first quarterly report for the design study for a Vehicular Intercommunication System primarily for tracked vehicles. The report covers the time period from 29 September through 31 December 1977. Accomplishments for the period included the establishment and documentation of functional, electrical and mechanical requirements for the vehicle commander and crew member stations. Preliminary tradeoff studies for techniques for wireless intercommunication for certain crew members were made. Results of initial investigations for control and signalling techniques are likewise included. Author (GRA)

N78-29328# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME RESULTS ON PHASE-CODED WAVEFORMS WITH APPLICATION TO REDUCTION OF INTERFERENCE BETWEEN RADARS
Dennis H. Pruslin 28 Feb. 1978 50 p refs
(Contract F19628-78-C-0002)
(AD-A054033; TN-1978-7; ESD-TR-78-30) Avail: NTIS HC A03/MF A01 CSCL 17/9

Some results on autocorrelation and cross-correlation properties of binary phase-coded radar waveforms are presented. The results are applied to a consideration of RFI reduction between radars and to questions of clutter suppression capability. Author (GRA)

N78-29329# University of Southern Calif., Los Angeles. Image Processing Inst.
IMAGE UNDERSTANDING RESEARCH Seminannual Technical Report, 1 Oct. 1977 - 31 Mar. 1978
Harry C. Andrews Mar. 1978 182 p
(Contracts F33615-76-C-1203; F33615-77-C-1016)
(AD-A054091; USCIPI-800) Avail: NTIS HC A09/MF A01 CSCL 17/8

The image understanding projects reported herein are maturing with symbolic matching, structure location, edge fitting, stochastic texture analysis and SVD feature selection, all being reported upon in some detail. The image processing projects present both new and concluding projects. New projects include double phase binary computer generated holograms and turntable radar imaging via coherent multi-frequency radar return processing. Older projects resulting in successful theoretics and experimental work include a posteriori restoration and perceptual model color image coding. Our on-going smart sensor project is expanding rapidly with old circuits being driven at near real time TV rates and new circuits being designed for 7 x 7 area processing for both enhancement and texture development. The Institute has installed a real time TV solid state refresh monitor and display at ARPA headquarters. This allows recent pictorial results to be made available over the ARPANET. Any and all contractors can make use of this device with software drivers available from the Institute. GRA

N78-29330# Florence Univ. (Italy). Ist. d'Elettronica.
SYNTHESIS OF BANDPASS SIGNALS THROUGH THE MINIMUM NUMBER OF SAMPLES
E. DelRe Mar. 1977 17 p refs
(R-5-77) Avail: NTIS HC A02/MF A01

A method is described for recovering a continuous bandpass signal by the minimum theoretical number of samples, employing in the final D/A conversion only lowpass filters with a frequency response depending on the signal bandwidth. Other methods are known for recovering bandpass signals from its samples. Some of them use a sampling frequency higher than the minimum theoretical sampling rate, others use this minimum frequency, but in both cases they generally make use in the final D/A conversion of analog bandpass filters with a frequency response depending on both the signal bandwidth and center frequency. A simple digital implementation of the described method, simulated by the computer and applied to the processing of some biomedical signals, is shown. Author (ESA)

N78-29331# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
COMPUTER AIDED EMC ANALYSIS - A REVIEW OF AVAILABLE TOOLS
O. B. M. Pietersen 21 Jun. 1977 29 p refs
(Contract NIVR-1782)
(NLR-TR-77070-U) Avail: NTIS HC A03/MF A01

Methods for the analysis of intrasystem electromagnetic compatibility are reviewed. Emphasis is placed on pocket calculator programs and on the SEMCAP computer program. Taking into account the applications at NLR, it is concluded that both tools can be very useful for such an analysis. As far as antenna-to-antenna coupling is concerned, the pocket calculator programs are adequate. For wire-to-wire coupling, the SEMCAP program has a number of advantages and is mandatory for complex systems. Author (ESA)

N78-29332# National Technical Information Service, Springfield, Va.
ELECTRONIC COUNTERMEASURES AND ELECTRONIC COUNTER COUNTERMEASURES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1977
William E. Reed Apr. 1978 254 p
(NTIS/PS-78/0336/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 17D

Methods and equipment for active and passive systems are presented in these research reports. Topics include electronic warfare, radar and radio jamming, antijamming, antiradar materials, and deception. This updated bibliography contains 249 abstracts. GRA

N78-29333# National Technical Information Service, Springfield, Va.
ELECTRONIC COUNTERMEASURES AND ELECTRONIC COUNTER COUNTERMEASURES, VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, May 1977 - Mar. 1978
William E. Reed Apr. 1978 84 p Supersedes NTIS/PS-77/0306; NTIS/PS-76/0330; NTIS/PS-75/165
(NTIS/PS-78/0337/2; NTIS/PS-77/0306; NTIS/PS-76/0330; NTIS/PS-75/165) Avail: NTIS HC $28.00/MF $28.00 CSCL 17D

Methods and equipment for active and passive systems are presented in these research reports. Topics include electronic warfare, radar and radio jamming, antijamming, antiradar materials, and deception. GRA

N78-29334# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
AUTOMATIC PATH DELAY CORRECTIONS TO GOES (GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITES) SATELLITE TIME BROADCASTS
J. V. Cateora, D. W. Hanson, and D. D. Davis Feb. 1978 52 p refs
(PB-279335/4; NBS-TN-1003) Avail: NTIS HC A04/MF A01 CSCL 14B

In support of the environmental data collection by the National Oceanic and Atmospheric Administration's (NOAA's) Geostation-

ary Operational Environmental Satellites (GOES), a time code has been incorporated into an interrogation message from these satellites by the National Bureau of Standards (NBS). This message is directed to data-collection platforms engaged in seismic, tsunami, hydromet and other related monitoring activities. The NBS has developed this time-code system to serve environmental data users who require only a few tenths of a second accuracy as well as those who need a more accurate time reference. The time code is available continuously from two geostationary satellites and provides a coverage of the Atlantic and Pacific Ocean Basins as well as the North and South American Continents. The time code includes the necessary information to compensate for free-space propagation delays between the master clock located at Wallops Island, Virginia, and the user. Preliminary results indicate a timing resolution of 10 microseconds. GRA

N78-29335# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
TRANSIENTS IN RESISTIVELY LOADED ANTENNAS AND THEIR COMPARISON WITH CONICAL ANTENNAS AND TEM HORNS
Motohisa Kanda Mar. 1978 36 p refs
(PB-279640/7; NBSIR-78-876) Avail: NTIS HC A03/MF A01 CSCL 09E

The receiving and transmitting transient responses for a relatively short, linear antenna with continuous resistive loading are investigated theoretically and experimentally. The antenna considered is a nonconducting cylinder with continuously deposited, varying-conductivity, resistive loading. The current distribution, the corresponding effective length, and the driving point impedance are calculated by use of the method of moments and compared with the Wu-King approximation. The receiving and transmitting transient responses are calculated in the frequency domain using the results of the effective length and driving point impedance. The use of FFT then allows the determination of transient fields for a known input waveform. The receiving and transmitting responses for a conical antenna and a TEM horn are also investigated theoretically to compare with the transient response of the resistively loaded antenna. GRA

N78-29336# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Telecommunications-Computer Applications.
A REVIEW OF SELECTED ACTIVITIES IN THE OFFICE OF TELECOMMUNICATION, DEPARTMENT OF COMMERCE Final Report, 1976 - 1977
Mar. 1978 21 p ref
(Contract C-5-35616)
(PB-279251/3; NRC/TELECOM-78/3) Avail: NTIS HC A02/MF A01 CSCL 17B

A review of selected activities in the Office of Telecommunications (OT), Department of Commerce by a panel of expert volunteers from industry and universities which recommends the most effective use of OT's limited telecommunications resources is discussed. OT's present and potential involvement is reviewed in the following technologies: Direct Satellite Communications; Land Mobile Radio, Fiber Optics; and Broadband Communications. Other OT activities examined by the panel include: Electromagnetic Spectrum Use; Radio Propagation, Data Communications Performance Standards; and information Sector Analysis. The panel review included visits to the OT Headquarters, Washington, D.C. and to OT's Institute of Telecommunications Sciences, Boulder, Colorado. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* ahp *76 Solid-State Physics*.

N78-29337 British Library Lending Div., Boston Spa (England).
ON CALCULATION OF ALTERNATING CURRENT SWITCHING PROCESSES AND PULSE DISTORTION IN NARROWBAND SYSTEMS
J. Lippmann Feb. 1978 11 p refs Transl. into ENGLISH from Nachrichtentechnik Elektronik (East Germany), v. 26, no. 4, 1976 p 152-155
(BLL-RTS-10557) Avail: British Library Lending Div., Boston Spa., Engl.: 7 BLL overseas, 8 European or 30 UK BLL Photocopy Coupons

Mathematical models are presented for determining the switching stability and expected step distortion occurring in the transmission of binary data by frequency-modulated signals. The program for calculating the transients and switching processes involved in the transmission of a.c. pulses through narrowband systems is written in FORTRAN. A.R.H.

N78-29338 British Library Lending Div., Boston Spa (England).
ON THE WIDTH OF THE COMMUTATION ZONE OF DIRECT CURRENT ELECTRICAL MACHINES WITH SMOOTH-CORE ARMATURES
Yu. A. Muratov Mar. 1978 8 p ref Transl. into ENGLISH from Izv. Vysshikh Uchebn Zavedeni i Elektromekhan. (Novocherkassk), no. 9, 1968 p 984-987
(BLL-RTS-10633) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL overseas, 8 European or 30 UK BLL Photocopy Coupons

To determine the width of the commutation zone of toothed armatures the following formula is used: b sub K = b sub 1u prime + (u - a/p + e) t sub K prime, where b sub 1u prime and t sub K prime are respectively the width of the brush in terms of the armature diameter, and the commutator segment, u is the number of section sides to the coil, a is the number of pairs of parallel paths, p the number of pole pairs, and e the short-pitching of the winding in the commutator segments. This expression was refined so as to apply it to the windings of smooth core armatures. The width of the commutation zone for two possible types of smooth core armature windings, double layer and single layer types, were considered. The results show that the width of the commutation zone in the smooth core armature is somewhat narrower and a greater pole overlap is possible in the main poles than is the case with the toothed armature. G.Y.

N78-29339 British Library Lending Div., Boston Spa (England).
MODELLING THE STATIC CURRENT-VOLTAGE FUNCTIONS OF TRANSISTORS ON ANALOGUE COMPUTERS, WITH REFERENCE TO THE GF 126 TRANSISTOR AS AN EXAMPLE
D. Reschke Dec. 1977 13 p refs Transl. into ENGLISH from Nachrichtentechnik (East Germany), v. 19, no. 9, 1969 p 334-336
(BLL-RTS-10955) Avail: British Library Lending Div., Boston Spa., Engl.: £ 7.50; 7 BLL overseas, 8 European or 30 UK BLL Photocopy Coupons

The exact analysis of electronic circuits by automatic computation is based on reproducing the nonlinearities contained in the relevant system of differential equations (describing diodes, transistors, etc.). An analog circuit is presented for modelling the function i sub c = f(i sub b, v sub cE) which describes the nonlinear relationship between the current amplification Beta and the collector current and voltage, including the residual voltage on the transistor. The functions required for modelling on analog computers are derived by digital computation from the transistor characteristics. G.Y.

N78-29340# British Library Lending Div., Boston Spa (England).
A NEW METHOD OF DETECTING DEFECTS IN ELECTRONIC DEVICES
Horst Roeder 19 Dec. 1977 10 p refs Transl. into ENGLISH from Frequenz (Berlin), vol. 31, no. 8, 1977 p 253-256
(BLL-PO-Trans-3553-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

A functional test is described for detecting concealed defects in electronic devices by measuring the phase noise. The measuring equipment is described, and the applications of this method are demonstrated. F.O.S.

N78-29341 British Library Lending Div., Boston Spa (England).
THE APPARENT RESISTANCE OF AERIALS
E. Siegel and J. Labus 20 Dec. 1977 25 p refs Transl. into ENGLISH from Hochfrequenztech. Elektroakust. (East Germany), vol. 43, 1934 p 166-172
(BLL-PO-Trans-3538-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

To determine the reactance and resistance of an antenna, the antenna is regarded as being replaced by a line and the characteristic impedance and the attenuation of the equivalent line are calculated. On the basis of line theory, formula for the resistance and reactance of antennas at the feed point are set up and the two quantities under consideration, and also the local curve of the apparent resistance of the antenna, are represented in diagrams whose substatial agreement with the available measurements is demonstrated. Simple formulas are set up for the reactance and resistance of the simple dipole (quarter wavelength antenna) and for the double dipole (half wavelength antenna) and the reactive power requirement of an antenna is calculated. An approximation formula for the speed of propagation along the antenna is indicated. G.Y.

N78-29342 Japan Broadcasting Corp., Tokyo. Information Processing Research Group.
EVALUATION OF THE CUMULATIVE FAILURE RATE OF A SYSTEM: THE OPTIMAL INTERVAL FOR PREVENTIVE REPLACEMENT OF TRAVELING WAVE TUBES
Shinji Yamanouchi Jan. 1978 8 p refs
(NHK-Labs-Note-222) Copyright. Avail: Issuing Activity

Changes in the cumulative failure rate of a repairable series system according to its total operating time can be determined by using the renewal process. The result obtained by calculating the change in the cumulative failure rate for the lifetime distribution of 10 W power output travelling wave tubes (TWT's), installed in certain types of NHK's television translators with transmission power of 10 watts, is applied to determining the optimal interval for simultaneous preventive replacement of costly parts like the TWT's. It was found that simultaneous preventive replacement is more economical than the individual replacement after failure when the interval of replacement is between two and three years. G.Y.

N78-29343 Stanford Univ., Calif.
THE TIME-SEQUENCED ADAPTIVE FILTER Ph.D. Thesis
Earl Roy Ferrara, Jr. 1978 104 p
Avail: Univ. Microfilms Order No. 7808790

A new type of adaptive filter is proposed which is especially suited for the estimation of a class of nonstationary signals. This time-sequenced adaptive filter is an extension of the least mean square error adaptive filter. Both the LMS and time-sequenced adaptive filters are digital filters composed of a tapped delay line and adjustable weights, whose impulse response is controlled by an adaptive algorithm. The time-sequenced adaptive filter uses multiple sets of adjustable weights. At each point in time, one and only one set of weights is selected to form the filter output and to be adapted using the LMS algorithm. The index of the set of weights chosen is synchronized with the recurring statistical character of the filter input so that each set of weights is associated with a single error surface. After many adaptations of each set of weights, the minimum point of each error surface is reached resulting in an optimal time-varying filter. Dissert Abstr.

N78-29344 Utah State Univ., Logan.
DESIGN AUTOMATION AND TESTING OF DIAGNOSABLE MOS COMBINATIONAL LOGIC NETWORKS Ph.D. Thesis
Yacoub Mahmud El-Ziq 1978 177 p
Avail: Univ. Microfilms Order No. 7808127

An efficient algorithm for computer-aided synthesis of MOS combinational logic networks is presented. The algorithm synthesizes a completely or an incompletely specified function of a large number of variables. It rapidly generates an easily-testable network with the near-minimum number of complex cells and FET's. The algorithm has been programmed in FORTRAN 4 for UNIVAC 1108 and the results of computer execution are discussed. Statistical data were taken to evaluate the performance of the algorithm and to demonstrate its efficiency. A new testing approach based on a matrix model is used to generate tests for the designed networks. Dissert. Abstr.

N78-29345 Stanford Univ., Calif.
KITCHIP: A SUPERIOR LOW POWER MONOLITHIC DEVICE ARRAY Ph.D. Thesis
Stephen Richard Combs 1978 215 p
Avail: Univ. Microfilms Order No. 7808774

Two KITCHIP arrays described in this report are tailored specially for low power biomedical telemetry systems for which no commercially available ICs exist. A bipolar KITCHIP was applied in 25 different circuit designs resulting in a bidirectional CW blood flowmeter, a 6 channel physiological parameter telemetry system, micropower command receivers, and an ingestible gastrointestinal telemetry pill. An advanced integrated circuit technology featuring two novel complementary biomodal transistors, is developed and implemented in a second monolithic KITCHIP array. Electrical characteristics of these transistors and related KITCHIP devices are analyzed in terms of physical parameters of their vertical impurity profiles and an impurity distribution optimized for biomedical telemetry applications is derived on a layer by layer basis. Dissert. Abstr.

N78-29346 Princeton Univ., N. J.
A STUDY OF RADIATION EFFECTS IN MOS CAPACITORS Ph.D. Thesis
John Joseph Clement 1978 81 p
Avail: Univ. Microfilms Order No. 7807466

MOS capacitors exposed to ionizing radiation at 87 K show very little interface-state generation for periods up to three hours. Upon warming the sample, interface states were formed. Both HCl-steam grown oxides and HCl-dry grown oxides showed similar behavior in this respect. The temperature dependence of the interface-state generation was investigated by heating the sample to progressively higher temperature followed by cooling to 87 K. Differences between the two types of samples could possibly be a result of the different processing steps involved in fabrication of the test samples. Although holes are involved in the interface-state generation process, only the temporary presence of holes at the SiO2/Si interface appears to be required. Even though any holes remaining in the oxide were annihilated by recombination with photoinjected electrons before the sample was warmed, the generation of interface state still occurred upon warming the sample. This behavior indicates that the interface-state generation process is electrochemical in nature rather than being purely electronic. Dissert. Abstr.

N78-29347 Texas Univ., Austin.
PROCEDURES FOR FUNCTIONAL PARTITIONING AND SIMULATION OF LARGE DIGITAL SYSTEMS Ph.D. Thesis
Ajoy Kumar Bose 1977 256 p
Avail: Univ. Microfilms Order No. 7807266

Criteria for feasible simulation are developed from considerations of accuracy and efficiency. The popular gate level circuit models are analyzed for the feasibility of simulating them at a functional level. For the feasible models, simulation procedures are developed which permit a stepwise increase in accuracy at little extra overhead. It is also shown that through minor modifications of this procedure, some of the well known problems associated with unknown signals and reconvergent fan outs can be solved. Based on these results, the implementation of a functional simulator is investigated. Two major simulator features are considered, those of partitioning to form functional modules and timing analysis. It is seen that in both cases, the resulting procedures are simple. Dissert. Abstr.

N78-29348 Stanford Univ., Calif.
IMPLEMENTATION AND ERROR ANALYSIS IN DIGITAL FILTERS BASED ON DIGITAL INCREMENTAL COMPUTERS Ph.D. Thesis
Ahmad Irsan Abu-El-Haija 1978 110 p
Avail: Univ. Microfilms Order No. 7808753

Sensitivity and roundoff errors can seriously limit the application of recursive digital filters in practice, particulary when the filter have poles near $z = +1$. A filter structure, based on digital incremental computers, is proposed which has low sensitivity, good error characteristics, and simple hardware implementation for pole locations close to $z = +1$. A design

procedure was suggested to implement the filter structure given the transfer function to be realized, and the relations among roundoff errors, dynamic range, and the size of the hardware multiplier are discussed. Implementing high order digital filters was also considered and simulation results are presented. In short, the structure was found to be matched to transfer functions which have all their poles clustered around z = +1.
Dissert. Abstr.

N78-29349*# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
MEASUREMENT TECHNIQUES FOR THE CHARACTERIZATION IN THE FREQUENCY DOMAIN OF REGULATED ENERGY-STORAGE DC-TO-DC CONVERTERS M.S. Thesis
David Dean Bahler 16 Aug. 1978 111 p refs
(Grant NGL-34-001-001)
(NASA-CR-157474) Avail: NTIS HC A06/MF A01 CSCL 10C

Procedures are presented for obtaining valid frequency-domain transfer functions of regulated reactor energy-storage dc-to-dc converters. These procedures are for measuring loop gain, closed loop gain, output impedance, and audio susceptibility. The applications of these measurements are discussed. F.O.S.

N78-29350*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.
MODELING AND ANALYSIS OF POWER PROCESSING SYSTEMS (MAPPS), INITIAL PHASE 2 Final Report
Yuan Yu, Fred C. Lee, Herb Wangenheim, and Dan Warren 22 Dec. 1977 427 p refs
(Contract NAS3-19690)
(NASA-CR-135173; TRW-27744.000) Avail: NTIS HC A19/MF A01 CSCL 09C

The overall objective of the program is to provide the engineering tools to reduce the analysis, design, and development effort, and thus the cost, in achieving the required performances for switching regulators and dc-dc converter systems. The program was both tutorial and application oriented. Various analytical methods were described in detail and supplemented with examples, and those with standardization appeals were reduced into computer-based subprograms. Major program efforts included those concerning small and large signal control-dependent performance analysis and simulation, control circuit design, power circuit design and optimization, system configuration study, and system performance simulation. Techniques including discrete time domain, conventional frequency domain, Lagrange multiplier, nonlinear programming, and control design synthesis were employed in these efforts. To enhance interactive conversation between the modeling and analysis subprograms and the user, a working prototype of the Data Management Program was also developed to facilitate expansion as future subprogram capabilities increase. Author

N78-29351*# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
MODELLING, ANALYSES AND DESIGN OF SWITCHING CONVERTERS
Slobodan Cuk and R. D. Middlebrook [1978] 320 p refs Prepared for TRW Defense and Space Systems Group, Redondo Beach, Calif.
(Contracts NAS3-19690; NAS3-20102)
(NASA-CR-135174; TRW-A72042-RHBE; TRW-D04803-CFCM) Avail: NTIS HC A14/MF A01 CSCL 09C

A state-space averaging method for modelling switching dc-to-dc converters for both continuous and discontinuous conduction mode is developed. In each case the starting point is the unified state-space representation, and the end result is a complete linear circuit model, for each conduction mode, which correctly represents all essential features, namely, the input, output, and transfer properties (static dc as well as dynamic ac small-signal). While the method is generally applicable to any switching converter, it is extensively illustrated for the three common power stages (buck, boost, and buck-boost). The results for these converters are then easily tabulated owing to the fixed equivalent circuit topology of their canonical circuit model. The insights that emerge from the general state-space modelling approach lead to the design of new converter topologies through the study of generic properties of the cascade connection of basic buck and boost converters. F.O.S.

N78-29352*# Martin Marietta Corp., Denver, Colo.
PRELIMINARY STUDY OF THE RELIABILITY OF IMAGING CHARGE COUPLED DEVICES Final Report
J. R. Beall, M. D. Borenstein, R. A. Homan, D. L. Johnson, D. D. Wilson, and V. F. Young Jun. 1978 117 p refs
(Contract NAS8-32641)
(NASA-CR-150761; MCR-78-572) Avail: NTIS HC A06/MF A01 CSCL 09C

Imaging CCDs are capable of low light level response and high signal-to-noise ratios. In space applications they offer the user the ability to achieve extremely high resolution imaging with minimum circuitry in the photo sensor array. This work relates the CCD121H Fairchild device to the fundamentals of CCDs and the representative technologies. Several failure modes are described, construction is analyzed and test results are reported. In addition, the relationship of the device reliability to packaging principles is analyzed and test data presented. Finally, a test program is defined for more general reliability evaluation of CCDs. Author

N78-29353*# Magcap Engineering, Canton, Mass.
DESIGN OF SPACE-TYPE ELECTRONIC POWER TRANSFORMERS
J. F. Ahearn and J. C. Lagadinos Nov. 1977 197 p refs
(NASA-CR-134992) Avail: NTIS HC A09/MF A01 CSCL 09C

Both open and encapsulated varieties of high reliability, low weight, and high efficiency moderate and high voltage transformers were investigated to determine the advantages and limitations of their construction in the ranges of power and voltage required for operation in the hard vacuum environment of space. Topics covered include: (1) selection of the core material; (2) preliminary calculation of core dimensions; (3) selection of insulating materials including magnet wire insulation, coil forms, and layer and interwinding insulation; (4) coil design; (5) calculation of copper losses, core losses and efficiency; (6) calculation of temperature rise; and (7) optimization of design with changes in core selection or coil design as required to meet specifications. A.R.H.

N78-29354# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENT OF THE COUPLING IMPEDANCE AND CROSS-TALK BETWEEN COAXIAL CONDUCTORS
L. Halme Apr. 1978 17 p refs Transl. into ENGLISH from Kraft och Ljus (Sweden), 3, 1964 p 68-73
(RAE-Lib-Trans-1961; BR63504) Avail: NTIS HC A02/MF A01

The measurement of the coupling impedance of coaxial conductors is described, and results presented for different outer cover designs. The relationship between the coupling impedance and cross-talk between conductors is discussed. G.Y.

N78-29355# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
APPLICATIONS OF MULTICONDUCTOR TRANSMISSION LINE THEORY TO THE PREDICTION OF CABLE COUPLING. VOLUME 4: PREDICTION OF CROSSTALK IN RIBBON CABLES Final Technical Report
Clayton R. Paul Griffiss AFB, N. Y. RADC Feb. 1978 64 p refs
(Contract F30602-75-C-0118)
(AD-A053548; RADC-TR-76-101-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 09/1

The prediction of crosstalk in ribbon cables is investigated. Experimental results are obtained for a 20 wire ribbon cable and compared to the predictions of the multiconductor transmission line (MTL) model. Based on the experimental configuration tested, it would appear that accurate predictions of crosstalk can be achieved in controlled characteristic cables such as these. The prediction accuracies are typically within + or - 1 dB for frequencies such that the line is electrically short (L = 1/10 lambda) and + or - 6 dB for frequencies such that the line is electrically long (L = 1/10 lambda). It was found that the parasitic wires in the cable can have a significant effect (as much as 40 dB for all frequencies) on the coupling between a

generator circuit and a receptor circuit in the cable. Therefore to achieve accurate predictions in ribbon cables, one must consider the interactions between all wires in the cable. The wire insulation evidently can be ignored when the line is electrically short but cannot be ignored for higher frequencies. Conversely, the impedance of the reference wire cannot be ignored for low frequencies where the common impedance coupling dominates the electromagnetic field coupling. Author (GRA)

N78-29356# Kentucky Univ., Lexington. Dept. of Electrical Engineering.

APPLICATIONS OF MULTICONDUCTOR TRANSMISSION LINE THEORY TO THE PREDICTION OF CABLE COUPLING. VOLUME 5: PREDICTION OF CROSSTALK INVOLVING TWISTED WIRE PAIRS Final Technical Report

Jack W. McKnight and Clayton R. Paul Griffiss AFB, N. Y. RADC Feb. 1978 248 p refs

(Contract F30602-75-C-0118)

(AD-A053559; RADC-TR-76-101-Vol-5) Avail: NTIS HC A11/MF A01 CSCL 09/1

A transmission line model of the twisted wire pair is presented which may be used to compute electromagnetic coupling between the twisted wire pair and other circuits. The model is derived by representing the transmission line for the twisted wire pair as a cascade of uniform loops and 'abruptly' nonuniform twists. The overall transmission line matrix is found by cascading the chain parameter matrices, which represent the loops, with the permutation matrices, that represent the twists. Comparisons are presented between the twisted wire pair, the straight wire pair, and the single wire circuit configurations to determine the relative effectiveness in the reduction of electromagnetic coupling. Experimental results are compared to the model predictions which verify that the chain parameter model is accurate to within + or - 3 dB for frequencies such that the line is electrically short (i . e. 1/10 lambda). Finally a second model, the low frequency model, is presented and is shown to be as accurate as the chain parameter model in the prediction of coupling at low frequencies. This low frequency model is very appealing in that it is conceptually much easier to model and also less time consuming, computationally. Author (GRA)

N78-29357# Kentucky Univ., Lexington. Dept. of Electrical Engineering.

APPLICATIONS OF MULTICONDUCTOR TRANSMISSION LINE THEORY TO THE PREDICTION OF CABLE COUPLING. VOLUME 6: A DIGITAL COMPUTER PROGRAM FOR DETERMINING THERMAL CURRENTS INDUCED IN A MULTICONDUCTOR TRANSMISSION LINE BY AN INCIDENT ELECTROMAGNETIC FIELD

Clayton R. Paul Griffiss AFB, N. Y. RADC Feb. 1978 198 p refs

(Contract F30602-75-C-0118)

(AD-A053560; RADC-TR-76-101-6-Vol-6) Avail: NTIS HC A09/MF A01 CSCL 09/1

The report describes a digital computer program which is designed to compute the terminal currents induced in a multiconductor transmission line by an incident electromagnetic field. Sinusoidal steady state behavior of the line is assumed. The transmission line is uniform and consists of n wires and a reference conductor immersed in a homogeneous, lossless, linear, isotropic medium. The n wires and the reference conductor are assumed to be lossless. The reference conductor may be a wire, an infinite ground plane or an overall, cylindrical shield. The incident electromagnetic field may be a uniform plane wave or a general nonuniform field. The primary restriction on the program validity is that the cross sectional dimensions of the line, e.g., wire separation, must be much less than a wavelength. Author (GRA)

N78-29358# Aerojet Electrosystems Co., Azusa, Calif.

INTEGRATED THIN-FILM TRANSISTOR DISPLAY Quarterly Technical Report, 28 Sep. - 31 Dec. 1977

W. J. Helm 14 Apr. 1978 44 p

(Contract DAAB07-77-C-0583)

(AD-A053627; AESC-5705-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report summarizes the work performed on a program whose purpose is to develop techniques for producing flat-panel electroluminescent displays with integrated thin-film transistor circuitry. Included are descriptions of the overall design and configuration of the display device; the design and structure of the electroluminescent elements, thin-film transistors, driver circuits, and addressing circuits of the display device; the processes and equipment being used to fabricate these devices; and the process development and improvement efforts being conducted. GRA

N78-29359# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

THE ANOMALOUS VOLTAGE RESPONSE OF THE P(+)N(-)N(+) DEVICE AND ITS EFFECTS ON SECOND BREAKDOWN Final Report, 1 Aug. - 30 Nov. 1977

G. W. Neudeck and L. R. Razouk Dec. 1977 229 p refs

(Grant DAAG29-77-G-0191; Z99QAXTB087)

(AD-A053539; TR-EE-77-40; ARO-15322.1-A-EL) Avail: NTIS HC A11/MF A01 CSCL 09/1

Numerical simulations and experimental measurements have been carried out to study the transient behavior of the P(+)N-N(+) structure under different levels of injection in both the reverse and the forward pulsed directions. A major part of this research is devoted to the explanation of the anomalous voltage that appears across the diode terminals when pulsed in the forward direction with current densities in the range of 1000 to 1,000,000 amp/sq cm. A numerical iterative method of solution of the one-dimensional basic two-carrier transport equations, coupled with Maxwell's and Poisson's equations, describing the behavior of the semiconductor device is presented. The pure implicit technique along with the Newton-Raphson iteration are used to solve the equations, while the explicit technique is used to obtain a first guess to start the iterative solution. A numerical method is arrived at for the determination of effective transient lifetimes in the case of excess diffusion due to very high current density. Author (GRA)

N78-29360# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

DEFENSE SATELLITE COMMUNICATIONS SYSTEM TRAVELING WAVE TUBE AMPLIFIER LIFE TEST REPORT. VOLUME 1: TWENTY WATT TWTA Final Report, 1 Apr. 1971 - 1 Nov. 1977

M. L. Kahn 1 Feb. 1978 434 p

(Contract F04701-74-C-0542)

(AD-A053739) Avail: NTIS HC A19/MF A01 CSCL 09/1

The purpose of this test was to operate six high level developmental traveling-wave tube amplifiers (TWTA) for the stated period of time at operating conditions specified in the Statement of Work, Program 777. The data obtained in this test is to be used as a basis for determining the long term operating performance of each TWTA. The test objective was to operate each TWTA at nominal ambient operating condition and environment to determine that each would maintain specified operating characteristics for the period of the life test as stated in The Program 777 Statement of Work for Traveling-Wave Tube Amplifier Life Testing Continuation. GRA

N78-29361# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

ELECTRICAL PROPERTIES OF Pb0.8Sn0.2Te EPITAXIAL FILMS Final Report

J. R. Lowney, R. F. Bis, and S. C. Foti 1 Dec. 1977 20 p refs

(SF54591501)

(AD-A053456; NSWC/WOL/TR-78-5) Avail: NTIS HC A02/MF A01 CSCL 20/12

The temperature dependences of the Hall coefficient and resistivity of Pb0.8 SnO2 Te epitaxial films have been measured from 4.2 to 300 K. The results show that no appreciable strain is induced in the epitaxial films grown on Ba F2 substrates because of differential thermal contraction below room temperature. Author (GRA)

N78-29362# Washington State Univ., Pullman. Shock Dynamics Lab.

ELECTRICAL RESPONSE OF A BIMETALLIC JUNCTION TO SHOCK COMPRESSION Final Report, 1 Nov. 1976 - 31 Dec. 1977

Douglas D. Bloomquist, George E. Duvall, and Jerry J. Dick
Mar. 1978 139 p refs
(Contract F49620-77-C-0034)
(AD-A053693; AFOSR-78-0728TR) Avail: NTIS HC A07/MF A01 CSCL 14/2

The electrical response of a copper-constantan junction to shock compression has been studied over a pressure range from 145 kbars to 360 kbars. Four possible sources of anomalous response were found; electrical noise due to circuit closure at impact, shock demagnetization of a ferromagnetic material, high local temperature at the junction interface due to shock compression of a surface damage layer, and two-dimensional flow in the pressurized region due to pressure relief from the edges. Using a diffusion welded junction the emf measured is within 20% of the predicted emf based on normal thermocouple response to shock compression temperatures. In a geometry in which a guard ring was used to maintain the pressure behind the shock front, the observed voltage-time profile was a step with constant plateau. In a similar configuration where radial pressure relief was allowed behind the shock front, the initial step, which compares directly in amplitude to the above results, is followed by a marked positive ramping. This ramping was directly correlated with the two-dimensional flow due to radial pressure relief. The results indicate that any fundamental anomaly which exists for one-dimensional strain is less than 10-20% of the observed signals in the pressure range studied.
Author (GRA)

N78-29363# IIT Research Inst., Chicago, Ill.
WISCONSIN TEST FACILITY GROUND TERMINAL CORROSION STUDY
Michael F. Genge, Edwin Wolkoff, and Paul V. Bergschneider
Apr. 1978 17 p refs
(Contract N00039-76-C-0141)
(AD-A053715; IITRI-E-6357-12) Avail: NTIS HC A02/MF A01 CSCL 09/1

Investigations of ELF ground system corrosion at the Navy's Wisconsin Test Facility were undertaken in response to concerns expressed by the National Academy of Sciences. Ground areas were excavated in several locations and the cable strand diameters measured for comparison with an unused cable. No evidence of corrosion in the ground system was observed. Author (GRA)

N78-29364# International Business Machines Corp., Hopewell Junction, N. Y.
DAMAGE PROFILES IN SILICON AND THEIR IMPACT ON DEVICE RELIABILITY Technical Report, 1 Apr. - 30 Sep. 1977
G. H. Schwuttke and K. H. Yang Sep. 1977 109 p refs
(Contract N00173-76-C-0303; ARPA Order 3231)
(AD-A053622; TR-22.2157; TR-2) Avail: NTIS HC A06/MF A01 CSCL 09/1

The influence of oxygen on the minority carrier lifetime of silicon is reported. Bulk annealed, oxygen-rich crystals subsequently sliced into wafers show lifetime degradation with annealing time. Silicon oxide precipitates and punched out dislocation loops induced during annealing are identified as electrically active defects responsible for the observed lifetime degradation. Increase in device yields (diodes) and improved lifetime in epitaxial films obtained with oxygen-rich wafers as substrates are a result of 'intrinsic gettering' of oxygen-rich wafers. It is shown that 'external gettering' can not improve minority carrier lifetime in silicon wafers if during processing 'intrinsic gettering' is activated. It also shows that external gettering such as impact sound stressing (ISS) is very effective in improving lifetime for wafers not containing 'intrinsic gettering' sources. Author (GRA)

N78-29365# Hughes Aircraft Co., Fullerton, Calif.
ELECTRONIC EQUIPMENT SCREENING AND DEBUGGING TECHNIQUES Final Report, Aug. 1976 - Sep. 1977
R. E. Schafer, S. P. Gray, L. E. James, and E. A. McMillan
Griffiss AFB, N. Y. RADC Mar. 1978 112 p refs
(Contract F30602-76-C-0395; AF Proj. 2338)
(AD-A053561; FR-77-16-995; RADC-TR-78-55) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report presents the results of a quantitative investigation into the optimum selection of screening and debugging methods for the purpose of removing defects, and hence improving reliability, throughout the development process. A computerized optimization model has been developed which can be used to address three problem areas; (1) Select an optimum sequence of screens for a fixed dollar expenditure, (2) Select a sequence of screens which minimizes costs in the face of a fixed desired reliability improvement, and (3) Provide quantitative for performing screening/debugging tradeoffs. In order to implement the model it was necessary to obtain data to compute test strengths and test costs. The model includes four assembly levels, five types of screens (temperature cycling constant temperature, vibration constant power and power cycling), provides for introduction of defects at each assembly level and includes the rework cycle. Author (GRA)

N78-29366# Parker (Lee W.), Inc., Concord, Mass.
POTENTIAL BARRIERS AND ASYMMETRIC SHEATHS DUE TO DIFFERENTIAL CHARGING OF NONCONDUCTING SPACECRAFT Final Report, 1 Jul. 1976 - 30 Sep. 1977
Lee W. Parker 1 Jan. 1978 57 p
(Contract F19628-76-C-0248; AF Proj. 7661)
(AD-A053618; AFGL-TR-78-0045) Avail: NTIS HC A04/MF A01 CSCL 20/3

The differential charging of a nonconducting spacecraft is modeled numerically by following charged-particle trajectories in a self-consistent space-charge-less sheath. In the presence of a plasma flow, but independent of any photoelectric or secondary emission, a potential difference between the front and wake surfaces of the spacecraft is generated, resulting in an asymmetric sheath and in the creation of a potential barrier for electrons. The potential difference can amount to volts in the ionosphere, and kilovolts in the solar wind, that is, large compared with the potentials typically generated by photoemission alone. As in the more familiar case of photoelectric charging, the asymmetric sheath and potential barrier produced by the plasma flow can lead to erroneous interpretations of experiments measuring space electric fields and low-energy particle spectra. In an example of photoelectric emission, a sunlit area on an otherwise dark surface becomes positively charged by the emission, and is found to acquire a potential more than twice the emitted energy relative to the dark surface. This effect is associated with the physics of the terminator bounding the sunlit and dark areas.
Author (GRA)

N78-29367# Range Commanders Council, White Sands Missile Range, N. Mex.
DIRECTORY OF TRANSDUCER USERS Final Report
May 1978 54 p
(AD-A053564) Avail: NTIS HC A04/MF A01 CSCL 09/1

The Directory of Transducer Users is a compilation of knowledgeable transducer personnel at various government activities, aerospace contractors and universities. The Directory has been published to promote the exchange of information between transducer users with common problems. The requirement for the first edition (1973) publication was generated at the 7th Transducer Workshop, which was hosted at Albuquerque, New Mexico, during April 1972, by the Transducer Committee, Telemetry Group, Range Commanders Council. The workshop concluded that a major problem existed in the lack of information exchange between transducer users. The Transducer Committee wishes to thank the people listed in the Directory for their willingness to make available their expertise and knowledge in the field of aerospace transducer specification, evaluation, calibration and use. The last page of this publication contains an application form for those government facility, university and aerospace contractor personnel who wish to be included in a later edition of the Directory. GRA

N78-29368# Westinghouse Electric Corp., Horseheads, N. Y. Industry and Government Tube Div.
MANUFACTURING METHODS AND ENGINEERING FOR TFT ADDRESSED DISPLAY Quarterly Report, 7 Aug. - 7 Nov. 1977
W. L. Rogers, F. C. Luo, H. Y. Wey, S. D. Burkholder, M. Green, and R. E. Stapleton 28 Feb. 1978 29 p refs
(Contract DAAB07-76-C-0027)
(AD-A054273; Rept-78-8L0-DISPL-R2; QR-6) Avail: NTIS HC A03/MF A01 CSCL 09/1

During this period the major emphasis has been on fabricating

a number of high quality displays. The process improvements previously identified as necessary for success were implemented with the result that the objective has been met. Four highly legible half panels were packaged into two engineering samples and tested. One sample incorporates a deposition sequence change which improved drift characteristics. A total of 38 substrates (starts) were made and evaluated on the basis of quality and transistor characteristics prior to packaging. This data has been summarized and tabulated. Abnormal transistor drift was an important factor contributing to rejects together with marginal mask alignment and mask to substrate contact. Parallel effort to resolve the problems of transistor drift was begun in the development activity. Author (GRA)

N78-29369# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J. Electronics Technology/Devices Lab.
THERMAL CYCLE TESTING OF 7-SEGMENT LIGHT EMITTING DIODES (LED) DISPLAYS. (TEST EVALUATION)
M. Robert Miller Jan. 1978 12 p
(DA Proj. 1L1-62705-AH-94)
(AD-A054418; DELET-TR-78-2) Avail: NTIS HC A02/MF A01 CSCL 09/1

Extended thermal cycle tests were performed on four types of LED numeric displays following observation of device failure during testing of equipment containing these displays. Two types which were epoxy encapsulated had failure rates of 1 percent and 0.17 percent per thermal cycle. No failures were observed in hermetically sealed devices or the devices that were potted in a resilient material. Author (GRA)

N78-29370# Tennessee Technological Univ., Cookeville. Dept. of Electrical Engineering.
DIPOLE ARRAY ON A TRANSMISSION LINE Final Report, 6 Jun. 1977 - 5 Feb. 1978
Shreedhar G. Lele Apr. 1978 35 p
(Grant AF-AFOSR-3378-77)
(AD-A054315; TTU-EE-78-1; AFOSR-78-0893TR) Avail: NTIS HC A03/MF A01 CSCL 09/5

Gain and pattern calculations have been made for an end-fire array of dipoles on a transmission line. For uniform dipole separation it is found that the array gain is a function of the line characteristic impedance and it attains a maximum value for a certain characteristic impedance. Two principal gain maxima are found to exist and the first one corresponding to a shorter uniform interdipole distance has a higher value and it is generally sharper than the other. An array with even number of dipoles has zero gain for the uniform interdipole distance of about half a wavelength. On the other hand, arrays with odd number of dipoles show a small relative maximum at the same interdipole distance. For a given line, the uniform dipole separation corresponding to the gain maxima appears to be independent of the termination. When the end-fire array gain is maximized by varying the interdipole distances and individual dipole lengths, the maximum array gain and the beam width seem to be more or less independent of the transmission line impedance and the termination. The maximum array gain is about N squared, where N is the number of dipoles in the array. Author (GRA)

N78-29371# Honeywell, Inc., Golden Valley, Minn. Ceramics Center.
PRODUCTION ENGINEERING MEASURE (PEM): MANUFACTURING METHODS AND TECHNOLOGY FOR PIEZOELECTRIC TRANSFORMERS Quarterly Progress Report, 14 Jan. 1977 - 14 Jan. 1978
William B. Harrison 1978 40 p
(Contract DAAB07-76-C-0008)
(AD-A054177; HONEYWELL-46585; QPR-7; QPR-8; QPR-9; QPR-10) Avail: NTIS HC A03/MF A01 CSCL 09/5

This combined Seventh, Eighth, Ninth and Tenth Quarterly report for Contract DAAB07-76-C-0008 describes the progress and status of this program to establish a cost-effective production capability for piezoelectric, ceramic transformers. The problems encountered in the confirmatory build portion of the program are described. After considerable effort on the many problems associated with the 25mm PET's, it was concluded that the costs associated with the construction of these units would not justify their substitution for the presently used wire-sound, step-up transformers. The work which has been implemented to correct the minor problems associated with the 18mm PET's is given with the current status of the testing of the confirmatory build samples. Author (GRA)

N78-29372# Douglas Aircraft Co., Inc., Long Beach, Calif. Government Avionics Dept.
PRECIPITATION STATIC ELECTRICITY AND SWEPT-STROKE LIGHTNING EFFECTS ON AIRCRAFT TRANSPARENCY COATINGS Final Report, 27 Feb. - 10 Dec. 1977
R. C. Twomey Dec. 1977 63 p refs
(Contract F33615-75-C-3105)
(AD-A054225; MDC-J7180; AFFDL-TR-77-141) Avail: NTIS HC A04/MF A01 CSCL 20/3

Swept stroke lightning and static electric discharges on aircraft windshields and canopies will induce large electrical transient currents into the fragile transparent conductive coatings which are used for anti-icing, de-fogging, and radar cross section control of these transparencies. A test program was conducted to study possible detrimental effects of these transient currents. Representative aircraft transparencies were subjected to laboratory simulated swept stroke lightning magnetic fields and static electric charging. Damage assessment methods included visual inspection with normal and polarized light, electrical resistance measurements of the conductive coating, and thermal inspection using a closed circuit infrared television technique. GRA

N78-29373# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
MNOS BORAM MANUFACTURING METHODS AND TECHNOLOGY PROJECT Quarterly Progress Report, 1 Jul. - 31 Dec. 1977
J. E. Brewer Jan. 1978 47 p
(Contract DAAB07-76-C-0048)
(AD-A054481; Rept-78-0332; QPR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

A manufacturing methods project has been initiated to establish a pilot production line for metal nitride oxide semiconductor (MNOS) block oriented random access memory (BORAM) multichip hybrid circuits. During the past reporting period the project has focused on definition of tests, development of test equipment and preparation of test programs. Author (GRA)

N78-29374# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Nov. 1977 - 31 Jan. 1978
Melvin A. Herlin and Alan L. McWhorter Feb. 1978 19 p
(Contract F19628-78-C-002; AF Proj. 649L)
(AD-A054478; ESD-TR-78-24) Avail: NTIS HC A02/MF A01 CSCL 09/3

This Quarterly Technical Summary covers the period 1 November 1977 through 31 January 1978. It consolidates the reports of Division (Data Systems) and Division 8(Solid State) on the Advanced Electronic Technology Program. Author (GRA)

N78-29375# Naval Civil Engineering Lab., Port Hueneme, Calif.
POWER SYSTEM SIMULATOR Final Report, Jul. 1971 - Jul. 1973
K. T. Huang Apr. 1978 117 p
(AD-A054476; CEL-TN-1519) Avail: NTIS HC A06/MF A01 CSCL 09/3

A power system simulator (PSS) that can be parametrically programmed to simulate the electrical transient performance of a medium-sized power system and its elemental components is described. It employs analog circuit modules to achieve simulation. Once programmed, the analog computer can be used to test the system for transients, load response, etc., by varying the parameters of the modules. The input and output terminals of these modules are interconnected according to a signal flow diagram of the selected power system to form a simulated power system. If a simulated transient is injected into an input terminal of the simulated power system, different transient responses will appear on the terminals of each module simultaneously. These responses can be recorded for use in transient analysis. The output of each module can also be read through an output meter on the front panel. Besides the transient simulation, the PSS can be used for studying electrical steady-state problems at various AC frequencies. A definite advantage of the analog

simulation is that voltages and currents can be recorded with meters or oscilloscopes at any point in the system.
Author (GRA)

N78-29376# Wisconsin Univ. - Madison. Mathematics Research Center.
PLANNING IN INTERCONNECTED POWER SYSTEMS: AN EXAMPLE OF TWO-STAGE PROGRAMMING UNDER UNCERTAINTY
Andras Prekopa Mar. 1978 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A054554; MRC-TSR-1835) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of planning in interconnected power systems is formulated as a stochastic programming model, a variant of the model: two stage programming under uncertainty. In this case the solvability of the second stage problem is required only for a probability near unity. GRA

N78-29377# Raytheon Co., Quincy, Mass. Industrial Components Operation.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES FOR HIGH DENSITY THICK FILM CIRCUITS USED IN CRYSTAL OSCILLATORS Quarterly Progress Report, 29 May - 27 Aug. 1977
C. G. Alex, Charles T. Martin, Richard Colson, and Charles Morris 8 May 1978 85 p refs
(Contract DAAB07-76-C-8119)
(AD-A054562; QPR-24) Avail: NTIS HC A05/MF A01 CSCL 09/5

Production techniques are being established for a thick film hybrid microelectronic 17-22 MHz, temperature-compensated, voltage-controlled crystal oscillator. In the engineering phase of the program, the redesign of the VCXO and TCFG substrates to relieve corral dimension and circuit density problems has been completed. The first lot of engineering samples has progressed through pre-aging electrical testing, and 5 units were undergoing aging at the close of the period. These units are non-conforming, having been assembled prior to the redesign effort. Units using redesigned substrates are in process. Author (GRA)

N78-29378# Sandia Labs., Albuquerque, N. Mex.
INTEGRATED CIRCUITS FOR MANAGERS
J. D. Williams and J. D. Heightley 1977 20 p
(Contracts EY-76-C-04-0789; AT(29-1)-789)
(SAND-77-0553C) Avail: NTIS HC A02/MF A01

The organization and structure of a course on integrated circuits designed specifically for managers is described. Semiconductor device and circuit characteristics necessary for planning and understanding systems employing these devices were presented. The major part of the material concerned MOS devices, but enough bipolar theory and discussion was presented to allow comparison between the technologies. The techniques used to cover a very broad range of topics in a one week course are discussed. The concept of a hardware dipolma and its utilization as a motivational tool is described. ERA

N78-29379# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRONICS ENGINEERING RESEARCH PROPOSALS FOR FY78
L. L. Cleland, M. P. Ekstrom, and E. K. Miller 1 Nov. 1977 44 p refs
(Contract W-7405-eng-48)
(UCID-17711) Avail: NTIS HC A03/MF A01

A reorganization of the Engineering Research Division (ERD) aimed at further expanding capabilities and being more responsive to needs is now complete. Six discipline related groups constitute the research elements in ERD. Three groups consitute the research elements in ERD. Three groups remained unchanged, one group was modified slightly, two groups were added, and one group was dissolved. The technical activities of each of the six research oriented groups within ERD are reported. ERA

N78-29380# Scientific Translation Service, Santa Barbara, Calif.
COMPUTER PROGRAM LK25OT: POWER FLUX CALCULATION AND THREE-POLE SHORT CIRCUIT CURRENT CALCULATION
W. Schulz Feb. 1978 77 p refs Transl. into ENGLISH of West German report, 30 Jun. 1973 77 p Sponsored by DoE
(DoE-tr-77) Avail: NTIS HC A05/MF A01

The LK 250T computer code for power flux calculation and three pole short circuit, current calculations for operational conditions and failure conditions of electric power transmission systems is described. The mathematical modeling of the system and the calculation steps are discussed. ERA

N78-29381# Analytical Services Co., Elkins Park, Pa.
DYNAMIC MODEL FOR COMPUTER CONTROL OF THE EXTRUSION OF SOLID DIELECTRIC CABLE
Jan. 1978 84 p refs
(Contract EX-76-C-01-1827)
(EPRI-EL-605) Avail: NTIS HC A05/MF A01

The state of the art in mathematical modeling and control of extrusion processes is reviewed. The problem of extruder control is defined. A control design methodology is described and the necessary dynamic model for control system design is formulated. ERA

N78-29382# Florence Univ. (Italy). Ist. di Elettronica.
A USEFUL COMPUTER PROGRAM FOR LC NETWORKS SYNTHESIS IN TIME DOMAIN
P. Barbini, A. Liberatore, and F. Lumini 1977 25 p refs
(R-8-77) Avail: NTIS HC A02/MF A01

The FORTRAN 4 program described allows synthesis in the time domain of LC network impedance matrices based on the reactance extraction technique. The program supplies the network topology and value of its elements whatever the dimension of the given matrix may be. ESA

N78-29383# Research Inst. of National Defence, Stockholm (Sweden).
A DIFFERENTIAL INPUT GAINRANGING AMPLIFIER EMPLOYING MONOLITHIC INTEGRATED CIRCUITS
Paul Mitlid Feb. 1978 18 p
(FOA-C-20221-E4) Avail: NTIS HC A02/MF A01

At the request of the Hagfors Observatory a gainranging amplifier for seismic measurements was developed with the goal of using components as simple, inexpensive, and easy-to-acquire as possible and also limiting dimensions as much as possible.
Author (ESA)

N78-29384# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - Mar. 1978
William E. Reed Apr. 1978 235 p Supersedes NTIS/PS-77/0299; NTIS/PS-76/0312; NTIS/PS-75/325
(NTIS/PS-78/0333/1; NTIS/PS-77/0299; NTIS/PS-76/0312; NTIS/PS-75/325) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Federally-sponsored research reports are cited on the design, development, application, reliability, and radiation effects of microwave oscillators. GRA

N78-29385# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Mar. 1978
William E. Reed Apr. 1978 259 p Supersedes NTIS/PS-77/0300; NTIS/PS-76/0313
(NTIS/PS-78/0334/9; NTIS/PS-77/0300; NTIS/PS-76/0313) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

An updated bibliography containing 252 abstracts concerning bibliography cites reports from worldwide research on the design, performance, properties, and applications of microwave oscillators including Gunn, impatt, transistor, trapatt, transferred electron, Schottky, and surface acoustic wave oscillators. GRA

N78-29386# National Technical Information Service, Springfield, Va.
PHASED ARRAYS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1978

William E. Reed Apr. 1978 145 p Supersedes NTIS/PS-77/0309, NTIS/PS-76/0308 and NTIS/PS-75/338
(NTIS/PS-78/0331/5; NTIS/PS-77/0309; NTIS/PS-76/0308; NTIS/PS-75/338) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

An updated bibliography containing 140 abstracts concerning the design, performance, radiation patterns, and applications of phased arrays are presented. Applications include communications, radar, optical, spacecraft, and navigational aids. GRA

N78-29387# National Technical Information Service, Springfield, Va.
PHASED ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Mar. 1978
William E. Reed Apr. 1978 250 p Supersedes NTIS/PS-77/0310 and NTIS/PS-76/0309
(NTIS/PS-78/0332/3; NTIS/PS-77/0310; NTIS/PS-76/0309) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

An updated bibliography containing 243 abstracts concerning reports from worldwide research on the design, performance, radiation patterns, and applications of phased arrays is presented. Applications include radar, communications, optical, electronic countermeasures, acoustic, aircraft, and spacecraft. GRA

N78-29388# National Technical Information Service, Springfield, Va.
GUNN EFFECT AND TRANSFERRED ELECTRON DEVICES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1977 - Mar. 1978
William E. Reed Apr. 1978 69 p Supersedes NTIS/PS-77/0255; NTIS/PS-76/0271; NTIS/PS-75/227
(NTIS/PS-78/0361/2; NTIS/PS-77/0255; NTIS/PS-76/0271; NTIS/PS-75/227) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

An updated bibliography containing 64 abstracts concerning the application of Gunn effect and transferred electron devices to microwave generation, amplification, and control is presented. The Gunn effect in semiconductors is discussed. The design, fabrication, and properties of Gunn diodes and transferred electron devices are included. GRA

N78-29389# National Technical Information Service, Springfield, Va.
GUNN EFFECT DEVICES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Mar. 1976 - Mar. 1978
William E. Reed Apr. 1978 230 p Supersedes NTIS/PS-0257
(NTIS/PS-78/0362/0; NTIS/PS-77/0257) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

An updated bibliography containing 223 abstracts concerning the application of Gunn effect devices to microwave generation, amplification, and control is presented. The Gunn in semiconductors is discussed. Design, fabrication, and properties of Gunn diodes are included. GRA

N78-29390# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE ENGINEERING DATA BASE Progress Report, 1973 - Apr. 1978
William E. Reed May 1978 242 p Supersedes NTIS/PS-77/0481; NTIS/PS-76/0361
(NTIS/PS-78/0471/9; NTIS/PS-77/0481; NTIS/PS-76/0361) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The bibliography cites worldwide research on the design, performance, and utilization of phase shifters and phase shift circuits. Citations cover ferrite, semiconductor, digital, and voltage controlled shifters. The applications include phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 235 abstracts. GRA

N78-29391# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - May 1977
William E. Reed May 1978 194 p
(NTIS/PS-78/0469/3-Vol-2) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The bibliography cites Federally-funded research on the design, performance, and utilization of phase shifters and phase shift circuits. The types include ferrite, semiconductor, digital, and voltage controlled. Applications cover phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 188 abstracts. GRA

N78-29392# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1977 - Apr. 1978
William E. Reed May 1978 144 p Supersedes NTIS/PS-77/0480; NTIS/PS-76/0360; NTIS/PS-75/154
(NTIS/PS-78/0470/1; NTIS/PS-77/0480; NTIS/PS-76/0360; NTIS/PS-75/154) HC $28.00/MF $28.00 CSCL 09E

The bibliography cites Federally-funded research on the design, performance, and utilization of phase shifters and phase shift circuits. The types include ferrite, semiconductor, digital, and voltage controlled. Applications cover phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 138 abstracts. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-29393 Columbia Univ., New York.
HYDRODYNAMIC THEORIES OF RELAXATION IN LIQUIDS Ph.D. Thesis
John Atterbury Montgomery, Jr. 1978 131 p
Avail: Univ. Microfilms Order No. 7809914

Molecular hydrodynamics is used to theoretically describe recent computer experiments on rough and partially rough sphere fluids. The long time behavior of hydrodynamic AVCF (angular velocity correlation function) is discussed. A theory of coupled translational and rotational relaxation in solution including the effects of hydrodynamic interaction is presented. The translational, translational-rotational diffusion tensors are computed using the method of hydrodynamic reflections. Time correlation functions are found from a coupled translational-rotational diffusion equation. The concentration dependence of rotational diffusion coefficients is calculated and compared with experiment data. The effect of many body hydrodynamic interactions is briefly considered.
Dissert. Abstr.

N78-29394 Minnesota Univ., Minneapolis.
FLUID MOTION BETWEEN TWO CYLINDERS ROTATING AT DIFFERENT SPEEDS Ph.D. Thesis
Jung Yul Yoo 1977 330 p
Avail: Univ. Microfilms Order No. 7809770

The secondary motion and the shape of the free surface of a liquid filling the gap between two concentric cylinders which rotate at different speeds are studied. Mathematical analysis was based on Joseph's domain perturbation theory which is developed from a perturbation of the rest state. The vertical stratification of the azimuthal circulation, the alteration of the shape of the free surface and the secondary motion were computed. The stream function was represented by a biorthogonal series whose convergence is very good when the edge data was good.
Dissert. Abstr.

N78-29395 California Univ., Los Angeles.
EXPERIMENTAL STUDY OF GAS ABSORPTION INTO TURBULENT FALLING FILMS OF LOW SURFACE TENSION LIQUIDS Ph.D. Thesis
Yong Sub Won 1978 103 p

Avail: Univ. Microfilms Order No. 7811394

The effects of liquid properties on liquid side mass transfer coefficients for a turbulent falling film were studied. The liquid film was formed on the inside wall of a 2.05 cm. I.D., 1.98 m long vertical tube. CO2 gas was absorbed into pure methanol and aqueous propanol solutions in six different mixture ratios, and H2 and O2 were absorbed into pure ethanol. These results, together with previous data for CO2 absorption into water, ethanol and aqueous ethylene glycol solution, were used to ascertain the effect of surface tension of the mass transfer coefficient. The mass transfer coefficient was found to increase with increase in surface tension, and to become less dependent on molecular diffusion coefficient as surface tension decreases, contrary to the constant one-half power dependence assumed in available theories. Dissert. Abstr.

N78-29396 Oklahoma State Univ., Stillwater.
ESTIMATION OF THE PERFORMANCE OF SHELL AND TUBE HEAT EXCHANGER SYSTEMS WHEN UNCERTAINTIES EXIST Ph.D. Thesis
Abdullah Sulaiman Al-Zakri 1977 233 p
Avail: Univ. Microfilms Order No. 7811024

The estimation of the performance of systems of heat exchangers when more than one heat exchanger is involved is very important in the evaluation of the total process system. To study the effect of uncertainties in the stream variables and heat exchanger parameters a computer program was developed for this purpose. The program uses the Monte Carlo technique of introducing random variables into the system model. The method was applied to a demonstration problem, a crude preheat train, and the results of the simulation to obtain the mean and standard deviation for each outlet stream temperature are discussed. The use of the method to predict the overdesign factor for each heat exchanger is presented along with a comparison with other methods. Dissert. Abstr.

N78-29397 Pittsburgh Univ., Pa.
ANALYSIS OF FLUID DYNAMICS DURING RAPID DEPRESSURIZATION OF SYSTEMS CONTAINING HIGH ENTHALPY WATER Ph.D. Thesis
Robert Kenneth Deremer 1977 256 p
Avail: Univ. Microfilms Order No. 78-09963

An analytical model was developed and substantially verified to predict the dependent behavior of water in a pipe during depressurization. This model accounts for bubble growth from nucleation sites existing in the water and assumes that the vapor phase is not in thermodynamic equilibrium with the liquid phase. The differential equations describing the depressurization phenomena are divided into two sets, each of which is assumed to act as a forcing function for the other. One set describes only the bubble behavior during the transient and the other set describes the overall behavior of the fluid system. The latter set of equations is solved using a method of characteristics. A digital computer program was written to facilitate solution of these equations and results are compared to pertinent experimental data. Dissert. Abstr.

N78-29398 Pittsburgh Univ., Pa.
HEAT TRANSFER DURING TRANSITION FROM FILM TO NUCLEATE BOILING OF WATER IN FORCE CONVECTION UPWARD FLOW Ph.D. Thesis
Mathew C. Jacob 1977 312 p
Avail: Univ. Microfilms Order No. 78-09964

An experimental facility was employed to perform fundamental quenching experiments under simple conditions with the aim of providing sufficient transient boiling data for comparison with steady state data. A thin-walled heater tube of 316 stainless steel material was chosen as the test section. The test section was completely dried out and heated to temperatures beyond the Leidenfrost point before being flooded from the bottom with subcooled water. The following ranges of parameters were investigated: 700-1000 F initial wall temperature, 90-215 psia pressure, 20-172 F fluid subcooling at inlet, and 700,000-1, 900, 000 lbm/hr-sq ft coolant inlet mass velocity. In addition to the transient boiling data, single phase forced convection and nucleate boiling data were collected on the test section at steady state conditions. Dissert. Abstr.

N78-29399 Illinois Univ. at Urbana-Champaign, Urbana.
AN ENERGY METHOD FOR ANALYZING WAVE PROPAGATION IN VISCOUS FLOW IN AN ELASTIC TUBE SURROUNDED BY AN ELASTIC MEDIUM Ph.D. Thesis
Oliver Shyi-Lin Wang 1978 147 p
Avail: Univ. Microfilms Order No. 78-11307

An energy method, known as the Hamilton's principle, is used for solving this problem. The Lagrange equations were modified in this work to include the kinetic energy and the potential energy of the system, and the constraint equation(s) linked by Lagrange multipliers. The modified Lagrange equations can be solved exactly and the characteristic parameters, such as the wave propagation speed, can be determined as functions of the properties and geometries of the system of concern. Two engineering applications were applied: one is to determine the elastic modulus of the arterial wall (which reflects the hardening of an arterial system); and the other is to determine the void fraction or quality of a two phase wet steam flow (which reflects the dryness of the steam). Both applications relate to the wave propagation speed of the system which is easier to measure externally. Dissert. Abstr.

N78-29400 State Univ. of New York at Stony Brook.
EXPERIMENTAL STUDY OF THE FLOW OF DRAG REDUCING FLUIDS IN A NARROW ISOSCELES TRIANGULAR DUCT Ph.D. Thesis
Shyh-Shyan Tung 1978 202 p
Avail: Univ. Microfilms Order No. 7810787

Velocity profiles for flows of both Newtonian fluids and Polyethylene-Oxide WSR-301 polymer solutions along the triangle height of a 11.5 degree isoceles triangular duct were studied by using a Laser Doppler Anemometer. The Newtonian data are compared with the analytical Newtonian velocity solutions and the existing Newtonian triangular data. Good agreement was obtained. Meanwhile, comparison of the velocity profiles between Newtonian fluids and polymer solutions are made in order to examine the effect of polymer additives on the profiles. The coexistence of laminar and turbulent flow in narrow triangular ducts is demonstrated by both flow visualization studies and velocity measurements for water flows as well as for polymer solutions. Pressure drops in both entrance region and fully developed region for both water and polymer solutions in 11.5 degree triangular duct were experimentally determined. Dissert. Abstr.

N78-29401 British Library Lending Div., Boston Spa (England).
LAWS FOR THE STRUCTURE OF TURBULENCE OF AXISYMMETRICAL JETS IN AN ACCOMPANYING CURRENT
V. T. Kiriltsev 1977 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 1, 1977 p 157-161
(BLLD-M-25563-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A relationship linking the longitudinal and transverse components of the pulsating velocity and the intermittent turbulence of jets is discussed. It is shown that in studying the pulsating velocity field in axisymmetrical turbulent currents, it is only necessary to measure one component of the pulsating field to determine the accompanying currents. F.O.S.

N78-29402 British Library Lending Div., Boston Spa (England).
INVESTIGATION ON A SLOW RUNNING CENTRIFUGAL PUMP AT DIFFERENT REYNOLDS NUMBERS
R. Rotzoll Mar. 1978 34 p refs Transl. into ENGLISH from Konstruktion (West Germany), v. 10, no. 4, 1958 p 121-130 (BLL-RTS-10585) Avail: British Library Lending Div., Boston Spa, Engl.: 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

To clarify the behavior of a centrifugal pump with changes in the Re number, experiments were carried out, based on work published in recent years, in which the Re number could be changed through various fluids, temperatures and speeds of rotation. After a brief description of the experiments and the method of measurement the results are discussed, compared with those of other work and the limits of applicability shown. Examples of two calculations are also given. Author

N78-29403 Aeronautical Research Labs., Melbourne (Australia).
THE RESPONSE OF TURBULENT SHEAR FLOWS TO DISCONTINUOUS CHANGES IN SURFACE ROUGHNESS
W. H. Schofield Nov. 1977 64 p refs
(ARL/Mech-Eng-Rept-150; AR-000-860) Copyright. Avail: Issuing Activity

The mean flow responses to a step change in roughness are considered in the context of growth of the new internal layer, of re-establishment of wall similarity and of a wall shear distribution. G.Y.

N78-29404 Princeton Univ., N. J.
SIMULATION OF SATURATED AND UNSATURATED DEFORMABLE POROUS MEDIA Ph.D. Thesis
Nader M. Safai 1978 495 p
Avail: Univ. Microfilms Order No. 7807494

A three-dimensional consolidation model is formulated to analyze and predict vertical and horizontal displacements and pore pressure changes due to flow of two immiscible fluids in a deformable porous medium. A three-dimensional deformation field is coupled with a three-dimensional hydrologic flow field. The governing equations are augmented by the proper constitutive relations. Subsequently, the system of the non-linear partial differential equation for saturated-unsaturated consolidation is obtained as a subset of the multiphase flow consolidation model. The model predicts the commonly ignored horizontal displacement in a variably saturated system undergoing simultaneous desaturation and deformation. Loading accelerates the soil compaction process. As Poission's ratio is increased, vertical displacement values are reduced, while excess pore pressure is slightly increased. Dissert. Abstr.

N78-29405 Tulsa Univ., Okla.
COMPUTER SIMULATION OF NON-DARCY TWO-PHASE FLOW IN OIL RESERVOIRS Ph.D. Thesis
Sif-el Kamel Kadi 1977 101 p
Avail: Univ. Microfilms Order No. 78-05699

A study of computer simulation was extended to single-phase oil and to two-phase (oil and gas) non-Darcy flow with emphasis on the inflow performance relationship (IPR). The research considers the following: (1) the pressure behavior of black oil non-Darcy flow, (2) two-phase non-Darcy flow behavior in a solution-gas drive reservoir; pressure and saturation were investigated, (3) flow-afterflow tests above and below the saturation pressure in a solution-gas drive reservoir with formation damage or improvement around the wellbore. Analysis of the numerical results reveals that the oil non-Darcy pressure drawdown behaves like water non-Darcy pressure drawdown as investigated by fluid dynamists; moreover, it also behaves like pressure drawdown in gas wells with turbulent flow. The formation flow capacity indicates the non-Darcy flow induces a skin which is rate dependent. Dissert. Abstr.

N78-29406 Wisconsin Univ., Madison.
FLUID MOTION IN PACKED BED REACTORS Ph.D. Thesis
Jerry Lewis Stephenson 1977 212 p
Avail: Univ. Microfilms Order No. 7804885

The radial and axial motion of marked quartz particles in a liquid flowing through a transparent model were recorded on video tape and coverted to motion picture films in order to calculate velocity distributions and particle displacement. A stochastic model based on continuous interchange between two veocity states describes the radial displacement data as successfully as the diffusion model, and has the advantage of allowing only finite displacements. The axial displacements gave skewed distributions for which the diffusion model is inappropriate. The corresponding modified axial Peclet numbers for purely convective dispersion were as much as two to ten times as large as those previously reported in the literature for convection with diffusion. The value of the axial dispersion coefficient depends on the observation period in contradiction of the diffusion model. Dissert. Abstr.

N78-29407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID PROPELLANT REORIENTATION IN A LOW-GRAVITY ENVIRONMENT
Irving E. Sumner Jul. 1978 52 p
(NASA-TM-78969; E-9716) Avail: NTIS HC A04/MF A01 CSCL 20D

An existing empirical analysis relating to the reorientation of liquids in cylindrical tanks due to propulsive settling in a low gravity environment was extended to include the effects of geyser formation in the Weber number range from 4 to 10. Estimates of the minimum velocity increment required to be imposed on the propellant tank to achieve liquid reorientation were made. The resulting Bond numbers, based on tank radius, were found to be in the range from 3 to 5, depending upon the initial liquid fill level, with higher Bond number required for high initial fill levels. The resulting Weber numbers, based on tank radius and the velocity of the liquid leading edge, were calculated to be in the range from 6.5 to 8.5 for cylindrical tanks having a fineness ratio of 2.0, with Weber numbers of somewhat greater values for longer cylindrical tanks. It, therefore, appeared to be advantageous to allow small geysers to form and then dissipate into the surface of the collected liquid in order to achieve the minimum velocity increment. The Bond numbers which defined the separation between regions in which geyser formation did and did not occur due to propulsive settling in a spherical tank configuration ranged from 2 to 9 depending upon the liquid fill level. B.B.

N78-29408*# California Univ., Berkeley. Lawrence Berkeley Lab.
MATHEMATICAL AND COMPUTATIONAL STUDIES OF EQUILIBRIUM CAPILLARY FREE SURFACES Final Report
Norman Albright, Nai-Fu Chen, Paul Concus, and Robert Finn Nov. 1977 170 p refs Sponsored in part by NSF
(NASA Order 67705-C; Contract W-7405-eng-48)
(NASA-CR-135345; UCID-3982; DOE/NASA/7405-78/1)
Avail: NTIS HC A08/MF A01 CSCL 20D

The results of several independent studies are presented. The general question is considered of whether a wetting liquid always rises higher in a small capillary tube than in a larger one, when both are dipped vertically into an infinite reservoir. An analytical investigation is initiated to determine the qualitative behavior of the family of solutions of the equilibrium capillary free-surface equation that correspond to rotationally symmetric pendent liquid drops and the relationship of these solutions to the singular solution, which corresponds to an infinite spike of liquid extending downward to infinity. The block successive overrelaxation-Newton method and the generalized conjugate gradient method are investigated for solving the capillary equation on a uniform square mesh in a square domain, including the case for which the solution is unbounded at the corners. Capillary surfaces are calculated on the ellipse, on a circle with reentrant notches, and on other irregularly shaped domains using JASON, a general purpose program for solving nonlinear elliptic equations on a nonuniform quadrilaterial mesh. Analytical estimates for the nonexistence of solutions of the equilibrium capillary free-surface equation on the ellipse in zero gravity are evaluated. Author

N78-29409*# California Univ., Berkeley. Lawrence Berkeley Lab.
MATHEMATICAL AND COMPUTATIONAL STUDIES OF THE STABILITY OF AXISYMMETRIC ANNULAR CAPILLARY FREE SURFACES Final Report
Norman Albright, Paul Concus, and Ilkka Karasalo Nov. 1977 190 p refs
(NASA Order 67705-C; Contract W-7405-eng-48)
(NASA-CR-135346; UCID-3983; DOE/NASA/7405-78/2)
Avail: NTIS HC A09/MF A01 CSCL 20D

Of principal interest is the stability of a perfectly wetting liquid in an inverted, vertical, right circular-cylindrical container having a concave spheroidal bottom. The mathematical conditions that the contained liquid be in stable static equilibrium are derived, including those for the limiting case of zero contact angle. Based on these results, a computational investigation is carried out for a particular container that is used for the storage of liquid fuels in NASA Centaur space vehicles, for which the axial ratio of the container bottom is 0.724. It is found that for perfectly wetting liquids the qualitative nature of the onset of instability changes at a critical liquid volume, which for the Centaur fuel tank corresponds to a mean fill level of approximately 0.503

times the tank's radius. Small-amplitude periodic sloshing modes for this tank were calculated; oscillation frequencies or growth rates are given for several Bond numbers and liquid volumes, for normal modes having up to six angular nodes. G.Y.

N78-29410*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
CTS TEP THERMAL ANOMALIES: HEAT PIPE SYSTEM PERFORMANCE Final Report
B. D. Marcus 30 Nov. 1977 61 p refs
(Contract NAS3-21012)
(NASA-CR-159413) Avail: NTIS HC A04/MF A01 CSCL 20D

A part of the investigation is summarized of the thermal anomalies of the transmitter experiment package (TEP) on the Communications Technology Satellite (CTS) which were observed on four occasions in 1977. Specifically, the possible failure modes of the variable conductance heat pipe system (VCHPS) used for principal thermal control of the high-power traveling wave tube in the TEP are considered. Further, the investigation examines how those malfunctions may have given rise to the TEP thermal anomalies. Using CTS flight data information, ground test results, analysis conclusions, and other relevant information, the investigation concentrated on artery depriming as the most likely VCHPS failure mode. Included in the study as possible depriming mechanisms were freezing of the working fluid, Marangoni flow, and gas evolution within the arteries. The report concludes that while depriming of the heat pipe arteries is consistent with the bulk of the observed data, the factors which cause the arteries to deprime have yet to be identified. L.S.

N78-29411# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Chemical Engineering.
INTERPRETATION OF THE TURBULENT FLOW IN THE VISCOUS WALL REGION AS A DRIVEN FLOW
Dimitrious T. Hatziavramidis and Thomas J. Hanratty Jan. 1978 183 p refs Prepared for ONR
(NR Proj. 062-558)
(AD-A053404; Rept-1) Avail: NTIS HC A09/MF A01 CSCL 20/4

A physical understanding of the flow phenomena in the viscous wall region is of considerable importance because most of the turbulent energy production takes place in this region, and because the estimation of turbulent transport is vital in describing a number of turbulent processes such as heat and mass transfer at large Schmidt or Prandtl numbers, the wave induced variation in the pressure and shear stress at the surface of a small amplitude wave, drag reduction, and inertial deposition of particles on a solid surface. GRA

N78-29412# Calspan Corp., Buffalo, N. Y.
COMPUTER PROGRAM FOR RELAXATION SOLUTIONS OF THE NONLINEAR SMALL DISTURBANCE EQUATIONS FOR TRANSONIC FLOW IN AN AXIAL COMPRESSOR BLADE ROW Interim Scientific Report
William J. Rae Apr. 1978 79 p refs
(Contract F44620-74-C-0059)
(AD-A053744; CALSPAN-AB-5487-A-3; AFOSR-78-0855TR) Avail: NTIS HC A05/MF A01 CSCL 13/7

This report contains a description of a computer program for calculating the three-dimensional transonic flow through a compressor blade row, in the nonlinear small-disturbance approximation, and for subsonic values of the inlet relative Mach number at the blade tip. The problem formulation is reviewed briefly; following this, a description of the program is given together with a listing and sample case. Author (GRA)

N78-29413# Cincinnati Univ., Ohio.
ANALYSIS AND NUMERICAL SOLUTION OF THREE-DIMENSIONAL VISCOUS INTERNAL FLOW PROBLEMS Final Report, 1 Jan. - 31 Dec. 1977
Kirti N. Ghia and Urmila Ghia Feb. 1978 43 p refs
(Grant AF-AFOSR-3191-77)
(AD-A053692; AFL-78-2-40; AFOSR-78-076023TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

This research is motivated by the need for accurate prediction of three-dimensional viscous flow in a turbine or compressor passage. As a major step towards the investigation of these problems, the three-dimensional entrance flow through ducts of various regular cross-sections, with longitudinal and transverse curvature effects, have been studied. The mathematical model has been formulated using time-averaged three-dimensional parabolized Navier-Stokes equations. The analysis has been developed using an existing two-equation turbulence model and is checked by obtaining satisfactory comparison of the present results for straight and curved circular pipes. The effects of the problem parameters on the flow fields are accurately evaluated and the limitations of the turbulence model have been briefly stated. Four related areas were identified and studied separately. These consist of the law of the wall, coordinate transformations and efficiency and accuracy of the numerical algorithm. The last three of these areas have been studied with some success already, and the additional analysis developed will be implemented in the basic turbulent-flow program to make the latter a truly predictive tool. GRA

N78-29414# Technology, Inc., Dayton, Ohio.
AN OPTIMIZATION STUDY FOR GENERATING SURFACE-ORIENTED COORDINATES FOR ARBITRARY BODIES IN HIGH RE-FLOW Final Report, Mar. - Sep. 1976
U. Ghia (Cincinnati Univ.), J. K. Hodge, and Wilber L. Hankey, Jr. Wright-Patterson AFB, Ohio AFFDL Dec. 1977 81 p refs Presented at 3d AIAA Computational Fluid Dyn. Conf., Albuquerque, N. Mex., Jun. 1977 Prepared in cooperation with Dayton Univ., Ohio
(Contract F33615-73-C-4155; F33615-76-C-3145)
(AD-A054047; AFFDL-TR-77-117) Avail: NTIS HC A05/MF A01 CSCL 20/4

The numerical coordinate-transformation technique for generating surface-oriented coordinates for arbitrary geometries is examined carefully in order to optimize the procedures involved, especially for high-Reynolds number flow. The areas studied include appropriate stretching of the viscous region while minimizing truncation error and optimum location of the far-field boundary for computational efficiency. Examination of certain limiting forms of the nonlinear partial differential equations for the coordinates is found to lead to useful information about the behavior of the numerical solutions. It also enables the development of a simple procedure for formulating an improved starting solution for the nonlinear equations. Finally, an effort is made to maintain local near-orthogonality for the coordinates in the physical domain. An implicit numerical method of solution, employing these optimization procedures, has led to reduction of the previously required computer time by an order of magnitude, for the cases examined. Author (GRA)

N78-29415# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Aeromechanics Div.
AN EXACT VELOCITY POTENTIAL SOLUTION OF STEADY, COMPRESSIBLE FLOW OVER ARBITRARY TWO-DIMENSIONAL AND AXISYMMETRIC BODIES IN SIMPLY CONNECTED FIELDS Final Report, 1 Mar. 1975 - 1 Aug. 1977
Thomas J. Plant Aug. 1977 85 p refs
(AF Proj. 1476)
(AD-A054462; AFFDL-TR-77-116) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report discusses the use of the automatic numerical generation of curvilinear body fitted coordinates to solve the exact velocity potential equation for steady, compressible flow over two-dimensional and axisymmetric bodies in simply connected fields. A system of partial differential equations consisting of a Poisson equation for each coordinate direction is used to numerically generate the coordinates. A new, fast method of evaluating non-homogeneous terms for application to the Poisson generation system helps to make the coordinates more orthogonal. The use of these curvilinear coordinates allows the exact velocity potential equations to be easily applied to diverse body shapes and boundaries. Author (GRA)

N78-29416# Solar, San Diego, Calif.
DEVELOPMENT OF A CERAMIC TUBE HEAT EXCHANGER WITH RELAXING JOINT Monthly Technical Progress Report, 1 Jan. 1978 - 1 Feb. 1978
Michael E. Ward and James C. Napier 10 Feb. 1978 42 p

(Contract EF-77-C-01-2556)
(FE-2556-13) Avail: NTIS HC A03/MF A01

Of all materials tested (sintered silicon carbide nc-430, super KT silicon carbide and alpha sintered silicon carbide), none were found to be permeable. Alpha sintered silicon carbide (Carborundum) extruded tubes were found to contain large voids/circumferential cracks in the tube walls. None of the ceramics tested has sufficient strength to be used without any thermal expansion provision between the ceramic tubes and metal shell and tubes connected to the same header. Glass joints made to date have failed the pressure-temperature tests due to small voids contained within the glass which are formed during glass firing. A ceramic to metal hemispherical compression joint was made and tested at 1300 F with an internal gas pressure of 80 psig and end load of 20 kgm for 25 hours without leakage. Buckling loads for tubes were determined as a function of tube length. Heat exchanger shell design and thermal sizing were started. Shell insulation requirements were estimated. ERA

N78-29417# Solar, San Diego, Calif.
DEVELOPMENT OF A CERAMIC TUBE HEAT EXCHANGER WITH RELAXING JOINT Monthly Technical Progress Report, 1 Feb. 1978 - 1 Mar. 1978
Michael E. Ward and James C. Napier 20 Mar. 1978 14 p
(Contract EF-77-C-01-2556)
(FE-2556-14) Avail: NTIS HC A02/MF A01

Progress is reported in the following areas: (1) 100 hour environmental tube interaction test; (2) incorporation of a metal bellows with a metal to ceramic hemispherical joint to relieve tube-to-tube expansion differences; (3) thermal sizing of heat exchanger; (4) design of ceramic components; and (5) calculation of tube stresses caused by thermal gradients and compressive loading. ERA

N78-29418# Research Inst. of National Defence, Stockholm (Sweden).
TODEP: A COMPUTER PROGRAM FOR TWO DIMENSIONAL WAVE PROPAGATION PROBLEMS AND DEFORMATION PROCESSES [TODEP - DATAMASKINPROGRAM FOER TVAADIMENSIONELLA VAAGUTBREDNINGSPROBLEM OCH DEFORMATIONSFOERLOPP]
Bo Einarsson Jul. 1977 99 p refs In SWEDISH
(FOA-C-20184-D4) Avail: NTIS HC A05/MF A01

A revised version, TODEP, of the program TOODY is presented. All calculations in TODEP are performed in double precision, and handling of the glide lines has been improved. Equations of states as well as further possibilities in the service programs were added. ESA

N78-29419# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
NOTES ON THE UNSTEADY RECTILINEAR MOTION OF A PERFECT GAS. PART 3: HOMOGENEOUS SOLUTIONS OF THE LAGRANGIAN EQUATIONS OF MOTION
J. A. Steketee Dec. 1977 49 p refs
(VTH-LR-258) Avail: NTIS HC A03/MF A01

A family of solutions for the Lagrangian equations of motion was constructed. The solutions are homogeneous in the Lagrangian coordinates h and t, and therefore display a form of similarity. It was found that all the members of the family, distinguished by the degree of homogeneity n, have the same velocity distribution and particle paths in the physical x,t-plane. Also, in the x,t-plane there is a simple similarity since the lines x = Ct are lines of constant speed u and constant speed of sound a. In particular the homentropic centered simple wave is a member of the family (n = 0), while for n = -(1 + 2 kappa) the flow of a Martin-Ludford gas appears. It is shown that two members of the family can be matched in such a way that the velocity u and pressure p are continuous across the common particle path. Author (ESA)

N78-29420# National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.
THEORY AND DESIGN OF CONVENTIONAL HEAT PIPES FOR SPACE APPLICATIONS
A. A. M. Delil 1 May 1977 170 p refs
(NLR-TR-77001-U) Avail: NTIS HC A08/MF A01

Possible operation principles and applications of heat pipes are scanned. The governing equations for a model of a conventional heat pipe (including the limits to the heat transfer capability) are derived. The theoretical derivation of the formulae for the various thermal resistances associated with heat transfer in and by heat pipes and the equations necessary for the calculation of the resulting temperature distributions is described. Design philosophy is presented and design procedures are illustrated. Data required for a proper heat pipe design are compiled. Typical space applications of heat pipes (both existing systems and possible future applications) are surveyed. Specific topics and problem areas associated with heat pipe use in space are indicated. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-29421* National Aeronautics and Space Administration. Pasadena Office, Calif.
MAGNETO-OPTIC DETECTION SYSTEM WITH NOISE CANCELLATION Patent
George W. Lewicki (JPL) and John E. Guisinger, inventors (to NASA) (JPL) Issued 27 Nov. 1973 5 p Filed 25 Feb. 1972 Sponsored by NASA
(NASA-Case-NPO-11954-1; US-Patent-3,775,570; US-Patent-Appl-SN-229287; US-Patent-Class-179-100.2CH; US-Patent-Class-340-174YC; US-Patent-Class-340-174.1M; US-Patent-Class-350-151) Avail: US Patent Office CSCL 14E

In a magneto-optic readout system, a polarized beam of light from a laser is subjected to the magneto-optical effect of a magnetic record medium, and then passed through an analyzer which resolves the beam into two orthogonal vector components so oriented that the two components are of equal amplitude when the angle of rotation due to the magneto-optic effect is zero. Separate photodetectors produce two output signals which are proportional to the amplitudes of the vector components. The two output signals are combined in a differential amplifier through separate logarithmic transfer circuits to produce an output signal proportional to the ratio of the two original detector signals. Official Gazette of the U.S. Patent Office

N78-29422# British Library Lending Div., Boston Spa (England).
DISPERSIVE AND NONDISPERSIVE ANALYSIS: COMPARISON OF THE TWO TECHNIQUES USED IN MICROANALYSIS BY MEANS OF AN ELECTRON MICROPROBE
F. Borile 20 Dec. 1977 21 p refs Transl. into ENGLISH from Met. Ital. (Italy), no. 11, 1976 p 541-548
(BLL-PO-Trans-3531-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

A comparison of two analysis systems, energy dispersion and wave light dispersion, is presented. The advantages and disadvantages of the two methods are discussed at length without, however, clarifying the problem of all those who are potentially interested in this investigation technique. G.Y.

N78-29423 Japan Broadcasting Corp., Tokyo. Recording Techniques and Memory Devices Research Group.
PCM VIDEO RECORDING USING A ROTATING MAGNETIC SHEET
Katsuya Yokoyama, Shozo Nakagawa, Hiromichi Shibaya, and Hironobu Katayama Dec. 1977 8 p
(NHK-Labs-Note-221) Copyright. Avail: Issuing Activity

The fundamental concepts used in designing the PCM-VTR, as well as details of the experimental equipment are presented. G.Y.

N78-29424*# Barnes Engineering Co., Waltham, Mass.
ADVANCED MULTISPECTRAL SCANNER (AMS) STUDY Final Report

30 Jun. 1978 217 p refs
(Contract NAS9-15323; Proj. 2738)
(NASA-CR-151753; MA-183T) Avail: NTIS HC A10/MF A01 CSCL 14B

The status of aircraft multispectral scanner technology was accessed in order to develop preliminary design specifications for an advanced instrument to be used for remote sensing data collection by aircraft in the 1980 time frame. The system designed provides a no-moving parts multispectral scanning capability through the exploitation of linear array charge coupled device technology and advanced electronic signal processing techniques. Major advantages include: 10:1 V/H rate capability; 120 deg FOV at V/H = 0.25 rad/sec; 1 to 2 rad resolution; high sensitivity; large dynamic range capability; geometric fidelity; roll compensation; modularity; long life; and 24 channel data acquisition capability. The field flattening techniques of the optical design allow wide field view to be achieved at fast f/nos for both the long and short wavelength regions. The digital signal averaging technique permits maximization of signal to noise performance over the entire V/H rate range. A.R.H.

N78-29425# Council for Scientific and Industrial Research, Pretoria (South Africa).
RECORDING OF MEASURING DATA ON A CASSETTE TAPE RECORDER USING COMMERCIAL FM COMPONENTS
H. J. Klewe 1978 7 p Transl. into ENGLISH of "Mebdatenaufzeichnung auf Kassettenrecorder unter Verwendung Handelsueblicher FM-Bausteine", Rept. DGLR-76-138 DFVLR Inst. for Flight Mech., Brunswick 7 p
(CSIR-Trans-1401; DGLR-76-138) Avail: NTIS HC A02/MF A01

Problems concerning the recording of flight data using gliders and light aircraft were explained by means of an example of a flight test program with the SB 10 glider. The SB 10 was selected as the test aircraft in which statistical data would be obtained on the magnitude and frequency of stresses on gliders and light aircraft during overland flights lasting several hours. For this purpose deflexion owing to vertical acceleration was measured at various points on the wings, as well as vertical acceleration in the fuselage and wingtips and the pitot pressure, i.e. the flight speed. B.B.

N78-29426*# Beta Industries, Inc., Dayton, Ohio.
INFRARED RADIOMETER FOR MEASURING THERMOPHYSICAL PROPERTIES OF WIND TUNNEL MODELS
Richard R. Corwin, Stephen L. Moorman, and Edward C. Becker Aug. 1978 45 p refs
(Contract NAS1-14678)
(NASA-CR-158898) Avail: NTIS HC A03/MF A01 CSCL 14B

An infrared radiometer is described which was developed to measure temperature rises of wind tunnel models undergoing transient heating over a temperature range of -17.8 C to 260 C. This radiometer interfaces directly with a system which measures the effective thermophysical property square root of rho ck. It has an output temperature fluctuation of 0.26 C at low temperatures and 0.07 C at high temperatures, and the output frequency response of the radiometer is from dc to 400 hertz. L.S.

N78-29427# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistic Research Lab.
PROPOSED DESIGN FOR A DIFFERENTIAL PRESSURE GAGE TO MEASURE DYNAMIC PRESSURE IN BLAST WAVES Final Report
Noel H. Ethridge Mar. 1978 27 p refs
(AD-A054372; AD-E430012; ARBRL-MR-02814) Avail: NTIS HC A03/MF A01 CSCL 14/2

The current technique for determining dynamic pressure in blast waves is subject to large errors below incident shock over pressures of 69 kPa (10 psi). It is shown that if a single pressure-sensing element can be used to measure the differential pressure between stagnation and side-on overpressures, then dynamic pressure can be determined with much less error. A design for a differential pressure gage is presented. A particular diaphram size and material are proposed, and several diaphram deflection-sensing techniques are indicated. The frequency response of the gage seems adequate for measurements of blast waves from large HE charges. Author (GRA)

N78-29428# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
COMPARATIVE TESTING OF NISKIN AND VECTOR AVERAGING CURRENT METERS
Leslie W. Bonde Apr. 1978 47 p refs
(Contract N00014-74-C-0146)
(AD-A054113; EG/G-TR-4618-0001) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report documents a current meter array composed of Niskin and Vector Averaging Current Meters, the data acquired and the results of comparing the two instruments. Data acquired by adjacent meters compared favorably. Author (GRA)

N78-29429# Los Alamos Scientific Lab., N. Mex.
MODERN ULTRAFAST STREAK CAMERA DEVELOPMENT AND APPLICATION REVIEW
A. J. Lieber 1977 7 p refs Presented at the Conf. on Electro-Optical Systems, Anaheim, Calif., 25 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2474; Conf-771040-4) Avail: NTIS HC A02/MF A01

A brief historical review of image tubes and their shuttering is given. Their use for X-ray detection is briefly discussed. ERA

N78-29430# Royal Netherlands Meteorological Inst., De Bilt.
THE ACCURACY OF ASPIRATION THERMOMETERS
W. H. Slob 1978 30 p refs
(KNMI-WR-78-1) Avail: NTIS HC A03/MF A01

The accuracy of an Assman-type thermometer was investigated as a function of wind speed and ventilation velocity. Errors originating from the outer radiation shield can attain values of about 10% of the temperature difference between the outer radiation shield and the unmodified air. These errors occur when the wind speed exceeds the ventilation velocity. They can be reduced by applying an insulating layer on the outer radiation shield. The temperature field around the meteorological mast at Cabauw, the Netherlands, was briefly investigated. Temperature errors of 0.1 to approx. 0.2 C were found at the leeward side of the tower on sunny days. A periodically heated thermometer was developed in order to detect errors due to moisture (rain, fog, drizzle) deposited on the thermometer. The evaporation of the moisture on the thermometer lasted several hours and the errors reached values between 0 and approx. 3 C. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-29431 City Univ. of New York.
LASER INDUCED VIBRATIONAL ENERGY TRANSFER AND CHEMICAL REACTIONS Ph.D. Thesis
Shiann-Tsai Lin 1978 137 p
Avail: Univ. Microfilms Order No. 7811164

Fluorescence risetimes and falltime were studied in approximately 5 micron and > 14 microns regions after Nu sub 2 mode of CD3Br is excited by a Q-switched CO2 laser. Around 5 micron, activation occurs in approximately 10 gas kinetic collisions and in the region beyond 14 microns, activation requires 77 collisions. Deactivation of both signals occurs at about the same rate, corresponding to 550 collisions. Mechanisms and comparisons to other systems are discussed in terms of energy gaps and breathing sphere parameters for the processes involved. Laser-induced isotope separation in SF6 and SF6 mixtures, reactions of SF6 and CH2F2 and a series of fluoromethanes have been studied by a simple, inexpensive pulsed TEA CO2 laser. This laser has output energy of approximately 3J and a pulse duration of 300 ns FWHM and a 700 ns tail. Dissert. Abstr.

N78-29432 Columbia Univ., New York.
LASER SPECTROSCOPY: STUDIES OF THE NO2 VISIBLE SYSTEM Ph.D. Thesis
David Lee Monts 1978 220 p

Avail: Univ. Microfilms Order No. 7809915

Spectroscopic nomenclature and concepts are presented, along with a brief historical review of earlier work on the NO2 visible system. The NO2 6125 A region is rotationally analyzed by the method of laser-induced fluorescence. These results as augmented by those of supersonic expansion excitation spectroscopy yielded a description of the rotational structure and perturbations in this complex region that could not be achieved by classical methods. Approximately 135 transitions were assigned, and it is found that as a whole the rotational structure of the four vibronic bands (6117 A, 6119 A, 6125 A, and 6126 A bands) observed in this region appear well behaved. The 6117 A band is found to be a hot band transition. Microdensitometer traces of the NO2 6125 A region were presented. Dissert. Abstr.

N78-29433 California Univ., Los Angeles.
FOCUSED LASER BEAM SCATTERING BY STATIONARY AND MOVING PARTICLES: A THEORETICAL STUDY Ph.D. Thesis
Selami Colak 1978 137 p
Avail: Univ. Microfilms Order No. 7811341

A general method of solution to laser beam scattering problems is presented. This method makes use of the plane wave spectrum representation of the beam. By this way beam scattering results can be considered as an integral superposition of the single plane wave scattering results. This method can not be used for scatterers with nonlinear properties, because superposition principle can not be applied for such cases. Several examples showing the applications of the method which is mentioned above, are given. In these examples; results of the focused laser beam scattering by the following particles are studied: small, arbitrarily shaped tenuous scatterers, exact solution for arbitrarily shaped homogeneous particles, a statistical ensemble of small dynamic particles (a dilute solution of spherical macromolecules), and a single, translating spherical scatterer. Discussions on the practical uses of the results of each example are presented. Dissert. Abstr.

N78-29434 Massachusetts Univ., Amherst.
PROTOTYPE MASER AMPLIFIERS FOR THREE MILIMETER WAVELENGTH Ph.D. Thesis
Apostle George Cardiasmenos 1978 243 p
Avail: Univ. Microfilms Order No. 7810693

A description is given of prototype designs for traveling wave maser amplifiers to be used at the new 13.7 meter millimeter wave telescope of the Five College Radio Astronomy Observatory near Amherst, Massachusetts. The maser amplifiers, using iron-doped rutile as the active maser material, have achieved 15 dB electronic gain in one prototype design over an instantaneous bandwidth of 140 MHz in the frequency range from 85-90 GHz. The use of a slot-fed-image-guide mode, and an alternative construction using a shielded microslot mode, provide a wide bandwidth coupling to the maser material, and are described and analyzed. A critical discussion is given of the scaling techniques employed in investigating these modes. The unique properties of uniaxial ferrites utilized as isolator material in the masers are discussed. Dissert. Abstr.

N78-29435*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER DOPPLER VELOCITY SIMULATOR Patent Application
John M. Franke, inventor (to NASA) Filed 28 Jul. 1978 17 p
(NASA-Case-LAR-12176-1; US-Patent-Appl-SN-929083) Avail: NTIS HC A02/MF A01 CSCL 20E

A laser Doppler velocity simulator for testing and calibration of reference beam laser velocimeters by simulating the movement of a target object is described. A rotating glass block continuously changes the optical path length of the laser velocimeter reference beam thus inducing a Doppler frequency shift. The magnitude of the frequency shift is a function of the known rate of change of the optical path length. The Doppler frequency shift registered by the velocimeter was compared to the calculated true Doppler frequency shift for calibration. NASA

N78-29436*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYSTEM OPTIMIZATION OF GASDYNAMIC LASERS, COMPUTER PROGRAM USER'S MANUAL
L. J. Otten, III, R. C. Saunders, III, and S. J. Morris (Langley Research Center, Hampton, Va.) Apr. 1978 49 p refs
(NASA-TM-73193; A-6865) Avail: NTIS HC A03/MF A01 CSCL 20E

The user's manual for a computer program that performs system optimization of gasdynamic lasers is provided. Detailed input/output formats are CDC 7600/6600 computers using a dialect of FORTRAN. Sample input/output data are provided to verify correct program operation along with a program listing. G.Y.

N78-29437# Defence Research Establishment Valcartier (Quebec).
TEA LASER EMISSION ON THE SEQUENCE BANDS OF CO2
P. Lavigne, J.-L. Lachambre, and G. Otis Apr. 1978 19 p refs
(AD-A054149; DREV-R-4105/78) Avail: NTIS HC A02/MF A01 CSCL 20/5

Laser emission on the sequence bands of CO2 has been achieved in a TEA amplifier by using either a hot-CO2 cell or a Michelson interferometer to prevent oscillation of the regular bands. It has been found that the insertion losses of the hot-CO2 filter severely limit the energy-extraction efficiency on the sequence bands. With the Michelson filter, output energies of 140 mJ on the P17 sequence line have been produced in a 33 cm long TEA amplifier. The relatively low efficiencies obtained suggest that the generation of high-intensity laser beams at the sequence-band frequencies would require the use of an oscillator-amplifier combination. Author (GRA)

N78-29438# Texas Instruments, Inc., Dallas. Equipment Group.
LASER RANGEFINDER/TANK THERMAL SIGHT INTEGRATION STUDY Final Report, 29 Jun. 1977 - 1 Feb. 1978
28 Feb. 1978 32 p refs
(Contract DAAK70-77-C-0153)
(AD-A054622; FR-1) Avail: NTIS HC A03/MF A01 CSCL 17/5

This report documents the results of a study to analyze a government-proposed design concept for integrating AN/GVS-5 Laser Rangefinder (LRF) modules into the AN/VSG-2 Tank Thermal Sight (TTS). The primary objectives of the study were to determine the compatibility of the two systems and to assess the impact of the proposed integration on the recurring costs associated with the production of the TTS systems. GRA

N78-29439# International Business Machines Corp., San Jose, Calif. Research Lab.
THE SYNTHESIS OF SUBSTITUTED NICKEL DITHIENE COMPLEXES WITH INTENSE ELECTRONIC TRANSITIONS IN THE INFRARED REGION Final Report, 1 Jun. 1976 - 30 Nov. 1977
A. Nazzal, R. W. Lane, J. J. Mayerle, and U. T. Mueller-Westerhoff 14 Apr. 1978 16 p refs
(Contract DAAG29-76-C-0052)
(AD-A054675; ARO-14027.1-CX) Avail: NTIS HC A02/MF A01 CSCL 20/5

This research was concerned with the synthesis of nickel dithiene complexes possessing laser Q-switching capability in the infrared region, particularly at wavelengths greater than 1.06 micrometers. Those factors exerting the largest influence on the energy of the relevant pi-pi* transition were investigated. The longest wavelength absorption obtained lies at 1.37 micrometers. Author (GRA)

N78-29440# Westinghouse Electric Corp., Pittsburgh, Pa.
DEVELOPMENT OF PUMPS FOR PULSE COMPRESSION LASER APPLICATIONS
N. T. Melamed, R. J. Zollweg, J. L. Pack, T. Henningsen, and J. T. Tveligdan 10 Mar. 1978 61 p refs
(Contract N00014-76-C-0935)
(AD-A054223; Rept-77-9C1-PULCO-R1) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report describes an effort aimed at developing a more efficient flash-lamp for pumping blue laser dyes. The work was supported by the Navy as part of their program to develop

laser sources which operate in the blue-green transmission band of sea water. The effort was based on the possible use of mercury lamps of the high pressure capillary type (AH6), with and without spectral additives. A wide range of operating conditions were explored. Those found most suitable for pumping Rh6G gave no better performance than xenon lamps, and tests designed to evaluate their use for pumping blue laser dyes also showed no evidence of improved performance. Additives for the spectrally enhanced lamps were chosen by means of a computer program. In general, the spectra of the additives conformed in a general way to those predicted by the program. However, operating difficulties primarily arising from lamp instabilities, precluded the useful application of these additives. An alternative approach, based on molecular radiators, is proposed. Author (GRA)

N78-29441# Litton Systems, Inc., Morris Plains, N. J. Airtron Div.

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING FOR NEODYMIUM DOPED YAG LASER RODS Quarterly Progress Report, 1 Sep. 1977 - 30 Nov. 1977

D. Dentz Jan. 1978 21 p

(Contract DAAB07-77-C-0375)

(AD-A054224; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 20/5

Additional polishing runs using the sixteen rod fixture were completed during this quarter. The polishing process previously developed was used with parallelism being obtained through dimensional control rather than interferometric monitoring. Work was begun to determine the influence of the fixture and mounting technique on rod end face parallelism. Author (GRA)

N78-29442# California Univ., Livermore. Lawrence Livermore Lab.

RADIO CHEMISTRY AS A DIAGNOSTIC IN LASER FUSION EXPERIMENTS

E. M. Campbell, H. G. Hicks, W. C. Mead, S. S. Glaros, L. W. Coleman, and W. B. Laird 1 Nov. 1977 12 p refs Presented at the APS Plasma Physics Meeting of the Am. Phys. Soc., Atlanta, 5-11 Nov. 1977

(Contract W-7405-eng-48)

(UCRL-79778; Conf-771136-23) Avail: NTIS HC A02/MF A01

Nuclear chemistry techniques were employed in an attempt to measure the density of high compression laser fusion targets. Radioactive 28Al atoms formed in the 28Si(n,p)28Al reaction arising from the interaction of the 14 MeV neutrons with the silicon atoms in the glass microsphere were counted at Lawrence Livermore Laboratory using a beta-gamma coincidence method. The detection system that is employed allows activities corresponding to 100 aluminum atoms to be measured. From the observed number of activated atoms, neutron yields, and code calculations, information on the density of the compressed fuel can be obtained. This method is particularly valuable when the target compression becomes great enough to prohibit previously employed diagnostic techniques to be used. In addition, technique which utilizes a radioactive tracer to measure the isotropy of the target debris blowoff are discussed. ERA

N78-29443# Los Alamos Scientific Lab., N. Mex.

LASER-FUSION PROGRAM AT LOS ALAMOS

R. B. Perkins 1977 54 p Presented at a Colloq. held at Wisconsin Univ., Madison, Wis., 17 Feb. 1977

(Contract W-7405-eng-36)

(LA-UR-77-174) Avail: NTIS HC A04/MF A01

A general introduction to laser fusion research at Los Alamos is given. Laser choices, CO2 lasers, target interaction experiments, and conceptual power plants are discussed. Author (ERA)

N78-29444# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Programs Div.

LASER FUSION POWER BALANCE MEASUREMENTS (PARTICLE TRANSMISSION DIAGNOSTICS)

Feb. 1978 68 p refs Sponsored by Electric Power Research Inst.

(EPRI-ER-591) Avail: NTIS HC A04/MF A01

The 50 GW Nd-glass laser at the Lockheed Palo Alto Research Laboratory was employed to produce inertially-confined plasmas, and the 3 MV Van de Graaf accelerator was employed as the source of the diagnostic proton beam. The overall system is conveniently divided into three basic subsystems: the Particle Beam Control System delivers a pulsed, monochromatic, and tightly focused beam of protons at the target spot; the Time-Energy Analysis System analyzes the transmitted beam in time and energy coordinates; and the Laser Timing and Synchronization System coordinates the interaction of the particle and laser beams. These three subsystems were completed in December, 1976, and tests of the combined system were carried out over the next several months. The results of these tests have indicated that the particle transmission technique is a feasible approach to density measurement in inertially-confined plasmas. Adequate solutions to the problems of background, temporal synchronization, and spatial overlap are demonstrated. ERA

N78-29445# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

ON SCATTERING DIAGNOSTICS WITH PERIODICALLY PULSED LASERS TO FOLLOW THE CONTINUOUS EVOLUTION OF TIME DEPENDENT PLASMA PARAMETERS

H. F. Doebele, K. Hirsch, and M. vonHellermann (Gesamthochschule Essen) Apr. 1977 28 p refs Submitted for publication

(IPF-77-5) Avail: NTIS HC A03/MF A01

The possibilities of using periodically pulsed lasers for plasma scattering diagnostics are discussed. An experiment with successful application of a periodically pulsed frequency-doubled Nd:YAG laser is described and results are given. Application of the method to monitor continuously, with millisecond time resolution, parameters of Tokamak type plasmas, is considered. Author (ESA)

N78-29446# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

PLASMA SCATTERING EXPERIMENTS WITH A PERIODIC Nd:YAG LASER AT 1.06 MICRON AND A Si-AVALANCHE DETECTOR

K. Hirsch, E. Holzhauer, R. Reischl, and H. F. Doebele (Gesamthochschule Essen) Jan. 1978 8 p refs Submitted for publication

(IPF-78-2) Avail: NTIS HC A02/MF A01

First spectra obtained by scattering from a hydrogen arc plasma using a periodically pulsed cw-pumped Nd:YAG laser are presented. Because of its high quantum efficiency at 1.06 micron a large-area Si-avalanche diode followed by a capacitance-compensating amplifier is used as detector. Author (ESA)

N78-29447# National Physical Lab., Teddington (England). Div. of Quantum Metrology.

DETERMINATION OF TEMPERATURE AND DIFFERENTIAL SCATTERING CROSS-SECTIONS FROM ROTATIONAL RAMAN SCATTERING OF LASER RADIATION AT 488.0 nm

K. C. Lapworth and D. J. Harrison Mar. 1978 52 p refs

(NPL-QU-43) Avail: NTIS HC A04/MF A01

Ambient air temperature was determined from the pure rotational Raman spectrum of nitrogen and oxygen excited by a one W argon-ion laser operating at 488.0 nm. Absolute differential scattering cross sections for all the accessible rotational lines were determined by using Rayleigh scattering to calibrate the system. These scattering cross sections are believed to be systematically too low due to the presence of Mie scattering occurring at the same wavelength as the Rayleigh scattering. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-29448 Minnesota Univ., Minneapolis.

DYNAMICS OF HIGH-SPEED LINKAGES WITH ELASTIC MEMBERS Ph.D. Thesis

Ashok Midha 1977 167 p

Avail: Univ. Microfilms Order No. 7809704

A great deal of attention has been given to the areas of

analysis and synthesis of linkages with elastic members within the past fifteen years. Recently, kinematicians have turned to the use of structural dynamics analysis techniques for ease in handling complex linkage systems on computers. With a very few exceptions, little attention has been given to the economy of the computational methods. After developing the equations of motion for a representative four-bar crank-rocker linkage, two computationally efficient numerical methods are generated. One method computes directly the periodic response, while the other is adaptable to the transient response analysis of the high-speed linkage. Dissert. Abstr.

N78-29449*# Mechanical Technology, Inc., Latham, N. Y.
HYDRODYNAMIC AIR LUBRICATED COMPLIANT SURFACE BEARING FOR AN AUTOMOTIVE GAS TURBINE ENGINE. 2: MATERIALS AND COATINGS Final Report
Bharat Bhushan, David Ruscitto, and Stanley Gray Jul. 1978 139 p refs
(Contracts NAS3-19427; EC-77-A-31-1040)
(NASA-CR-135402; CONS/9427-2) Avail: NTIS HC A07/MF A01 CSCL 11A

Material coatings for an air-lubricated, compliant journal bearing for an automotive gas turbine engine were exposed to service test temperatures of 540 C or 650 C for 300 hours, and to 10 temperature cycles from room temperatures to the service test temperatures. Selected coatings were then put on journal and partial-arc foils and tested in start-stop cycle tests at 14 kPa (2 psi) loading for 2000 cycles. Half of the test cycles were performed at a test chamber service temperature of 540 C (1000 F) or 650 C (1200 F); the other half were performed at room temperature. Based on test results, the following combinations and their service temperature limitations are recommended: HL-800 TM (CdO and graphite) on foil versus chrome carbide on journal up to 370 C (700 F); NASA PS 120 (Tribaloy 400, silver and CaF2 on journal versus uncoated foil up to 540 C (1000 F); and Kaman DES on journal and foil up to 640 C (1200 F). Kaman DES coating system was further tested successfully at 35 kPa (5 psi) loading for 2000 start-stop cycles. A.R.H.

N78-29450# Southampton Univ. (England). Dept. of Mechanical Engineering.
THE BEHAVIOUR OF CENTRIFUGAL PUMPS OPERATING WITH HEAVY OILS
K. Pantell Nov. 1977 25 p Transl. into ENGLISH from Erdoel Kohle (Hamburg), no. 11, Nov. 1953 p 715-720
(ME/77/28) Avail: NTIS HC A02/MF A01

The effect is investigated of increased fluid viscosity on the characteristics of a centrifugal pump. A method is developed for predicting the performance curves at higher viscosities from the data obtained during water tests. There is good agreement between these calculated efficiency values and the experimental results. The prediction of pump performance when run on liquids of lower kinematic viscosity than water was studied. F.O.S.

N78-29451*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TORQUING PRELOAD IN A LUBRICATED BOLT
H. Lee Seegmiller Aug. 1978 14 p refs
(NASA-TM-78501; A-7503) Avail: NTIS HC A02/MF A01 CSCL 13I

The tension preload obtained by torquing a 7/8 in. diam UNC high strength bolt was determined for lubricated and dry conditions. Consistent preload with a variation of + or - 3% was obtained when the bolt head area was lubricated prior to each torque application. Preload tensions nearly 70% greater than the value predicted with the commonly used formula occurred with the lubricated bolt. A reduction to 39% of the initial preload was observed during 50 torque applications without relubrication. Little evidence of wear was noted after 203 cycles of tightening. Author

N78-29452# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF BENDING STRESSES IN A SPUR GEAR TOOTH
Yu. N. Bunakov May 1977 8 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), 1967 p 94-96
(RAE-Lib-Trans-1923; BR63467) Avail: NTIS HC A02/MF A01

The bending stress of spur gear teeth is estimated assuming it approximates a cantilever of varying thickness and applying Ritz's variational method for point loading. The stress is determined for a particular case showing the increase near the end of the teeth. Author

N78-29453# Aeronautical Research Labs., Melbourne (Australia).
DESIGN AND TESTING OF A SMALL FEEDWATER PUMP
D. Dyett Oct. 1977 14 p
(AD-A053646; ARL/MECH-ENG-TM-387) Avail: NTIS HC A02/MF A01 CSCL 13/11

This memo records the design and testing of a small positive displacement feedwater pump required in connection with experiments on steam atomization. The pump is of four cylinder radial type direct coupled to a variable speed drive. The design flow rate of 20 liters per hour at 1400 kPa was satisfactorily achieved with minimal pulsing. Author (GRA)

N78-29454# Battelle Columbus Labs., Ohio.
THE ROLE OF TEMPERATURE IN EHD Final Report, 1 Oct. 1975 - 31 Dec. 1977
Jerold W. Kannel, Thomas A. Dow, and Fred A. Zugaro 10 May 1978 53 p refs
(Contract N00014-76-C-0215)
(AD-A054320; BATT-G-6306; ONR-CR229-018-2F) Avail: NTIS HC A04/MF A01 CSCL 11/8

A special bisignal transducer has been developed which measures the contact pressure and temperature between a pair of rolling contact disks. Data have been recorded for four common lubricants for different loads, speeds, and conditions of disk sliding. Author (GRA)

N78-29455# Army Materials and Mechanics Research Center, Watertown, Mass. Process Development Div.
EFFECT OF SPOT AND STUD WELDING ON ESR 4340 STEEL ARMOR Final Report
Donald C. Buffum Feb. 1978 15 p
(DA Proj. 1T1-62105-AH-84)
(AD-A054025; AMMRC-TR-78-5) Avail: NTIS HC A02/MF A01 CSCL 13/5

The object of this project was to determine the effect of spot and stud welding on heat-treated ESR armor. It was noted that a hard layer of untempered martensite formed in the base metal below the spot and stud welds. Variations in welding technique did not remove or reduce this hard layer. The hard layer caused the welded appendage to be separated from the plate by the shock wave produced by ballistic impact. Heat treatment of the stud welds reduced the hardness of the hard layer without significant effect on the base plate. This reduced the tendency for the appendage to spall off as a result of the ballistic shock wave. Author (GRA)

N78-29456# Army Materials and Mechanics Research Center, Watertown, Mass. Process Development Div.
AUTOMATIC CONTROL OF WELD PENETRATION Final Report
Donald C. Buffum Feb. 1978 14 p refs
(AD-A054026; AMMRC-TR-78-6) Avail: NTIS HC A02/MF A01 CSCL 13/5

The objective of this project was to incorporate an infrared thermal probe with the previously developed weld penetration controller to improve penetration control of welds in 3/8 in.-thick ESR 4340 armor. The weld penetration control system works satisfactorily and reproducibly. The welding process used was gas tungsten arc. Author (GRA)

N78-29457# Northrop Corp., Hawthorne, Calif.
WELDBRAZE AIRFRAME COMPONENTS Final Report, 1 May 1976 - 31 Aug. 1977
R. G. Hocker Nov. 1977 123 p
(Contract F33615-76-C-5111)
(AD-A054042; NOR-77-115; AFML-TR-77-171) Avail: NTIS HC A06/MF A01 CSCL 01/3

The objective of this program was to develop materials and processes necessary to establish weldbrazing as a useful manufacturing technique that satisfies the structural property

requirements for advanced aerospace applications. Several surface preparation methods were evaluated. Spot weld schedules were established for two, three, and four-layer joints; and for three-sheet thickness combinations. Methods were developed for determining the proper quantity of filler metal to be placed at the joint edge prior to brazing and for holding the filler metal in place when weldbrazing in the vertical position. Lap-joint properties were determined for Ti-6Al-4V with aluminum filler metals 1100, 3003, 4043, 5052, 201, 718, AVCO 48, and Al-32Cu-5Ag. GRA

N78-29458# Timken Co., Canton, Ohio.
TAPERED ROLLER BEARING DEVELOPMENT FOR AIRCRAFT TURBINE ENGINES Interim Report, 8 Oct. 1976 - 8 Oct. 1977
P. S. Orvos and G. J. Dressler Wright-Patterson AFB, Ohio AFAPL Dec. 1977 97 p refs
(Contract F33615-76-C-2019)
(AD-A054045; AFAPL-TR-77-83) Avail: NTIS HC A05/MF A01 CSCL 13/9

Evaluation tests at speeds to 3.5 million DN were conducted on seven cage designs for high speed tapered roller bearings. These designs were comprised of three geometric and material options and two surface coatings. The race guided Z-type machined from AISI 4340 steel and silver plated proved to be the best design. Performance tests were conducted on both this design and a roller guided cage. The parametric investigation included effects of speed, lubricant viscosity, load, lubricant distribution and cage design on bearing heat generation (torque). Additionally, oil off tests were run to simulate oil supply cessation. Two sets of bearings operating at 1.5 million DN under 2000 lbf. thrust load survived for greater than one minute without impairment of rotational capabilities. Author (GRA)

N78-29459# Atomics International, Golden, Colo. Rocky Flats Plant.
ELECTRON-BEAM FUSION WELDING OF BERYLLIUM
R. P. Campbell, R. D. Dixon, and A. L. Liby 1 Jan. 1978 29 p refs
(Contract EY-76-C-04-3533)
(RFP-2621) Avail: NTIS HC A03/MF A01

Ingot-sheet beryllium (Be) having three different chemistries and three different thicknesses was fusion-welded by the electron-beam process. Several different preheats were used to obtain 100% penetration and crack-free welds. Cracking susceptability was found to be related to aluminum (Al) content; the higher Al-content material was most susceptable. However, adequate preheat allowed full penetration and crack-free welds to be made in all materials tested. The effect of a post-weld heat treatment on the mechanical properties of these compositions was also determined. The heat treatment produced no significant effect on the ultimate tensile strength. However, the yield strength was decreased and the ductility was increased. These changes are attributed to the formation of AlFeBe4 and FeBe11. ERA

N78-29460# Liquid Metal Engineering Center, Canoga Park, Calif.
APPLICATIONS OF CAVITATION ANALYSIS TO DESIGN AND OPERATION OF SPTF-HFL PUMP LOOPS
W. M. Bowers 1977 35 p
(Contract EY-76-C-03-0700)
(SAN/0700-1; R-051E-B03-TI008) Avail: NTIS HC A03/MF A01

A consistent set of cavitation equations were developed in a form suitable for conceptual design of SPTF (Sodium Pump Test Facility) modifications or use as an operational aid. However, to apply the equation as design tools or operational aids, certain cavitation test data must be available. It is recommended that incipient cavitation conditions be induced on valve HV-130 in the existing loop and the acoustic data on cavitation be collected. ERA

N78-29461# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
TEST AND EVALUATION OF AN ALUMINUM OXIDE BALL AND SEAT IN A BALL VALVE
J. F. Gardner Oct. 1977 25 p
(MERC/RI-77/3) Avail: NTIS HC A02/MF A01

Results of tests performed for the evaluation of a ceramic aluminum oxide ball and seat installed in a 6-inch WKM Class 300, full port ball valve are documented. The valve was MERC Valve Number 0612 obtained from the Morgantown Energy Research Center (MERC) 42-Inch Gas Producer. The valve body and ceramic are shown. The valve was subjected to 50 cycles of alternate pressure and operation. The ceramic ball experienced substantial chipping along the port edge and along the edge of the stem socket. After 50 operating cycles, the leakage increased by approximately 25%. Analysis of the damaged ball indicated the chipping was caused by stress concentration at the edges. The use of ceramic parts in ball valves requires careful design to avoid stress concentration. Duplication of a metal ball and seat design generally will not work. Additional care should be taken to assure an improved finish of the ball and seat surfaces over that evidenced in the sample tested. ERA

N78-29462# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
WEAR TESTS WITH PTFE-BEARINGS AT VARYING LOADS
Gunnar Carlsson 1976 16 p refs
(Contract FMV-F-INK-82223-75-007-07-001)
(FFA-TN-HU-1755) Avail: NTIS HC A02/MF A01

Tests were carried out at room temperature with spherical bearings of type SKF ADR RL 15R. The purpose was to measure the wear at radial loads varying between 60,000 and 20,000 N through an angle of + or - 25 deg. The same type of bearings was also tested at a constant radial load of 40,000 N through angles + or - 25 deg and + or - 10 deg and at 30,000 N through an angle of 25 deg. The frequency of the angular rotation was 10 cycles/min for all bearings. Each bearing was mounted in a lug or link by means of a spinning tool. The radial wear limit 0.1 mm was observed only when the program included loads up to 60,000 N. It was also observed that the rotational torque decreased during testing. Author (ESA)

N78-29463# Research Inst. of National Defence, Stockholm (Sweden).
A MODEL FOR THICK-TARGET PROJECTILE PENETRATION BASED ON INSTRUMENTED-PRESSURE-BAR RECORDING OF PENETRATION FORCES
Aake Persson 1977 14 p refs
(FOA-B-20016-D4; ISBN-91-7056-048-X) Avail: NTIS HC A02/MF A01; Res. Inst. of Natl. Defence, Stockholm Sw.Kr. 5

A simple model for the response of a relatively thick target normally impacted by a rigid sphere was formulated starting from explicit expressions for the influence of elastic-plastic and friction forces, forces of inertia, and impact and rear surface edge effects. An experimental setup in which a target was fired against an instrumented pressure bar is described. The strain-gage output signals from a series of such experiments with varying velocities permit the parameters of the model to be determined. The results from the investigation of two target materials (soft and hard aluminum) are presented. The model was checked by firing steel balls against aluminum targets. The time-distance histories found by X-ray flash radiography compare favorably with those predicted by a computer code based on the formulated model. The future development of the model to other target materials, other projectile shapes, oblique impact angles, and deformable projectiles is also discussed. Author (ESA)

N78-29464# Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
SKID RESISTANCE STUDY Final Report, Aug. 1969 - Aug. 1972
William C. Walters Jun. 1977 98 p refs
(PB-279588/8; RR-112; LA-69-1G; FHWA/LA-112) Avail: NTIS HC A05/MF A01 CSCL 13B

Skid characteristics of 19 hot mixed dense graded, asphaltic concrete overlay projects placed primarily to improve the riding surface are presented. The deterioration of the skid resistance with time and traffic, mix properties and their skid characteristics, and the merits of photointerpretation of the surface texture are discussed. A statistical and economical evaluation of running statewide skid resistance inventor for Louisiana was also included.

The final method of running such an inventory is presented. GRA

N78-29465# Charles River Associates, Inc., Cambridge, Mass.
INDUCING THE DEVELOPMENT AND ADOPTION OF SOCIALLY EFFICIENT AUTOMOTIVE TECHNOLOGY Final Report, Jan. - Jun. 1977
Hayden Boyd Feb. 1978 63 p refs Sponsored by DOT
(PB-279454/3; CRA-322; DOT-TSC-RSPD-78-4) Avail: NTIS HC A04/MF A01 CSCL 13F

Federal policies for inducing the development and adoption of innovative automobile technology are examined using a welfare economics framework. Socially efficient technology was defined, and criteria were identified for evaluating public policies; these include (1) feasibility and efficacy; (2) mechanism for tradeoffs; (3) information requirements; (4) incentives for information generation; (5) incentives for optimizing technology; and (6) effects on uncertainty. Current and alternative policies were evaluated by the criteria. Policies which place greater reliance on market forces, product information, and fiscal incentives can overcome many of the barriers to innovation which confront performance standards. GRA

N78-29466# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
COMPUTER SIMULATION OF THE EFFECT OF ROAD ROUGHNESS ON TIRE-PAVEMENT FORCES IN BRAKING AND CORNERING Interim Report, Sep. 1976 - Sep. 1977
P. F. Bohn and H. D. Dunkle Sep. 1977 113 p refs Sponsored by DOT, Wash. D.C.
(PB-279887/4; APL/BCE-T-0674) Avail: NTIS HC A06/MF A01 CSCL 13F

The research examined, through computer simulation, the effect of road roughness on tire-pavement forces in braking and cornering on a road of skid number 50. In addition to the force information, braking performance, measured by stopping distances, and cornering performance, measured by a stability factor which indicates understeer, were investigated. Vehicle performance was accessed on five road surfaces: smooth, two actual recorded road profiles, and two periodic profiles. Two vehicles were simulated - (1) 1971 Dodge Coronet passenger car, and (2) 1974 White Road Boss single unit truck. The White truck was loaded to maximum gross weight. The simulation utilized was the Hybrid Computer Vehicle Handling Program (HVHP) which is a nonlinear representation of four wheeled vehicles. GRA

N78-29467# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ANALOG AND DIGITAL COMPUTER SIMULATION OF COULOMB FRICTION Interim Report
R. Heller, J. M. Tuten, P. S. Kadala, and E. H. Law Dec. 1977 61 p refs
(Contract DOT-OS-40018)
(PB-279465/9; FRA/ORD-78/07) Avail: NTIS HC A04/MF A01 CSCL 13F

Coulomb friction, such as found in the suspension system of railway freight cars, can strongly influence dynamic behavior. The Coulomb friction nonlinearity must be accurately implemented in computer simulations of multi-degree-of-freedom dynamic models. This report proposes three computer models for friction and analyzes their performance in analog and digital computer simulations. Simulation techniques used are described in detail. Performance of each friction model is compared to analytical results. The accuracy, advantages, and disadvantages of each model are discussed. Recommendations on the use of the proposed friction models are included. GRA

N78-29468# Dynamic Science, Phoenix, Ariz.
EVALUATION OF ROLLOVER PROCEDURES: 45 DEGREE DOLLY ROLLOVERS Final Report, Oct. 1976 - Jul. 1977
Sep. 1977 324 p
(Contract DOT-HS-6-01427)
(PB-279392/5; DOT-HS-803-262; Rept-8306-77-120) Avail: NTIS HC A14/MF A01 CSCL 13F

Federal Motor Vehicles Safety Standard No. 208 presently contains requirements for a rollover test for vehicles equipped with passive restraint systems. In that test procedure, the test vehicle has no longitudinal velocity and thus the procedure does not closely simulate a realworld highway rollover. The objective of this program was to develop a rollover procedure in which the vehicle is oriented at 45 degrees to its line of travel. Four preliminary tests were conducted in accordance with the current FMVSS No. 208 procedure. Three 1972 Vega hatchbacks and one 1971 Vega hatchback were used in these tests. Five 45 deg tests were conducted using 1972 Chevrolet Vega hatchbacks. Moment-of-inertia values were determined for one of the test vehicles. Vertical and lateral suspension force/deflection characteristics were measured for all five vehicles. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-29469# British Library Lending Div., Boston Spa (England).
ACCELERATED RELIABILITY TESTS ON ELECTRONIC COMPONENTS AND EQUIPMENT
Karl George Kiessling Nov. 1977 11 p refs Transl. into ENGLISH from Radio Fernsehen Elektronik (Berlin), v. 26, no. 2, 1977 p 43-44 Presented at Conf. on Accelerated Reliability Testing, Zielona Gora, Poland, May 1975
(BLL-PO-Trans-3557-(7737.47)) Avail: British Library Lending Div., Boston Spa, Engl.

The failure behavior of electronic instruments depends predominately on the components used in them. For testing electronic components the failure rate represents the typical reliability parameter. The failure rate of reliability tests rises with an increase in electrical loading. The failure rate increases as a function of stress. A discussion on stress as the parameter for determining failure rates is presented. It is concluded that thermal stress is the only method for accelerated reliability testing. G.Y.

N78-29470# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM. STORAGE RELIABILITY ANALYSIS SUMMARY REPORT. VOLUME 1: ELECTRICAL AND ELECTRONIC DEVICES Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Jan. 1978 332 p refs
(Contract DAAK40-74-C-0853)
(AD-A053405; LC-78-2-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 10/3

This report summarizes analyses on the non-operating reliability of missile electrical and electronic devices. The analyses are part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. The objective of the program is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. Included are analyses of integrated circuits, semiconductors, vacuum tubes, resistors, capacitors, inductive devices, crystals, batteries connections, connectors and printed wiring boards. This report updates and replaces report LC-78-2 dated May 1976. Author (GRA)

N78-29471# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM. STORAGE RELIABILITY SUMMARY REPORT. VOLUME 3: HYDRAULIC AND PNEUMATIC DEVICES Final Report, Jun. 1974 - Jan. 1978
Joe C. Mitchell Jan. 1978 129 p refs
(Contract DAAK40-74-C-0853)
(AD-A053409; LC-78-2-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 09/5

This summary documents findings on the non-operating reliability of valves, accumulators, actuators, pumps, cylinders, compressors, filters, gaskets and seals, bearings and regulators. The failure rates for each of the parts are given with one sided 90% confidence limits calculated. Elements of design are reviewed and predominant failure modes and mechanisms are discussed. This information is part of a research program being conducted

by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. GRA

N78-29472# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM. STORAGE RELIABILITY SUMMARY REPORT. VOLUME 4: ORDNANCE DEVICES Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Feb. 1978 52 p refs
(Contract DAAK40-74-C-0853)
(AD-A053406; LC-78-2-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report summarizes analyses on the non-operating reliability of missile ordnance devices. The analyses are part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Al. The objective of the program is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. Included are analyses of solid propellant rocket motors, gas generators, igniters, safe and arm devices, and other explosive devices. Reliability models are developed for each component type. This report updates and replaces Report LC-76-2 dated May 1976. GRA

N78-29473# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM. STORAGE RELIABILITY SUMMARY REPORT. VOLUME 5: OPTICAL AND ELECTRO-OPTICAL DEVICES Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Feb. 1978 29 p
(Contract DAAK40-74-C-0853)
(AD-A053407; LC-78-2-Vol-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report summarizes analyses on the non-operating reliability of missile ordnance devices. Primary non-operating data is on TV seeker components. Operating models from MIL-HDBK-217B are summarized for laser devices. This analyses is part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. Author (GRA)

N78-29474# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, ELECTRONIC VACUUM TUBE ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik and Oscar L. Soler Jan. 1978 52 p refs
(Contract DAAK40-74-C-0853)
(AD-A053402; LC-78-VT1) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report documents findings on the non-operating reliability of vacuum tubes. A Weibull distribution is used to describe the failure distribution for high power tubes. This information is part of a research program being conducted by the U.S. Army R and D Command, Redstone Arsenal, Alabama. Author (GRA)

N78-29475# Raytheon Co., Huntsville, Ala.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM. MISSILE MATERIEL RELIABILITY PREDICTION HANDBOOK, PARTS COUNT PREDICTION Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik and Joe C. Mitchell Feb. 1978 365 p refs
(Contract DAAK40-74-C-0853)
(AD-A053403; LC-78-1) Avail: NTIS HC A16/MF A01 CSCL 17/7

This handbook contains data for predicting the reliability of missile systems based on a 'parts count' approach. The handbook is part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. Included is data on electronic, electrical, electromechanical, hydraulic, pneumatic, ordnance, and electro optical devices. Author (GRA)

N78-29476# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, GYROSCOPE ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Feb. 1978 31 p refs
(Contract DAAK40-74-C-0853)
(AD-A053411; LC-78-EM1) Avail: NTIS HC A03/MF A01 CSCL 16/4

This report updates report LC-76-EM1, dated May 1976, and covers findings from the research program on gyroscopes. The program approach on these devices has included literature and user surveys, data bank analyses, data collection from various military systems and special testing programs. Author (GRA)

N78-29477# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, ACCELEROMETER ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Feb. 1978 23 p refs
(Contract DAAK40-74-C-0853)
(AD-A053412; LC-78-EM2) Avail: NTIS HC A02/MF A01 CSCL 09/1

This report documents findings on the non-operating reliability of accelerometers. Long term non-operating data has been analyzed and reliability predictions have been developed for accelerometers. This report is a result of a program whose objective is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. The analysis results will be used by U.S. Army Personnel and contractors in evaluating current missile programs and in the design of future missile systems. Author (GRA)

N78-29478# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, RELAY ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Redstone Arsenal, Ala. Army Missile Res. and Develop. Command Feb. 1978 51 p refs
(Contract DAAK40-74-C-0853)
(AD-A053413; LC-78-EM3) Avail: NTIS HC A04/MF A01 CSCL 17/8

This report documents findings on the non-operating reliability of relays. The study covers 2086 million part-hours. Elements of relay design and of the processes at the contacts are reviewed. The possibilities of solid state and saturable core alternatives are described. Recommendations include periodic test and inclusion of oxygen in the fill gas. This information is part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. The objective of this program is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. This report updates and replaces report LC-76-EM3 dated May 1976. Author (GRA)

N78-29479# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, MONOLITHIC BIPOLAR SSI/MSI DIGITAL AND LINEAR INTEGRATED CIRCUIT ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Redstone Arsenal, Ala. Army Missile Res. and Develop. Command Jan. 1978 111 p refs
(Contract DAAK40-74-C-0853)
(AD-A053415; LC-78-IC1) Avail: NTIS HC A06 MF A01 CSCL 13/7

This report documents findings on the non-operating reliability of monolithic bipolar SSI/MSI digital and linear integrated circuits. Real time storage and accelerated testing results were analyzed and integrated to develop a non-operating reliability prediction model. Failure mechanisms are also discussed in detail. GRA

N78-29480# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, SWITCH ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Dennis F. Malik Redstone Arsenal, Ala. Army Missile Res. and Develop. Command Feb. 1978 28 p refs
(Contract DAAK40-74-C-0853)
(AD-A053414; LC-78-EM4) Avail: NTIS HC A03/MF A01 CSCL 09/3

This report documents findings on the non-operating reliability of switches. Long term non-operating data has been analyzed

and reliability predictions have been developed for switches. This report is a result of a program whose objective is the development of non-operating (storage) reliability prediction and assurance techniques for missile materiel. The analysis results will be used by U.S. Army personnel and contractors in evaluating current missile programs and in the design of future missile systems. Author (GRA)

N78-29481# Raytheon Co., Huntsville, Ala. Dept. of Life Cycle Analysis.
STORAGE RELIABILITY OF MISSILE MATERIEL PROGRAM, MISSILE SYSTEMS BATTERY ANALYSIS Final Report, Jun. 1974 - Jan. 1978
Joe C. Mitchell Redstone Arsenal, Ala. Army Missile Res. and Develop. Command Feb. 1978 59 p refs
(Contract DAAK40-74-C-0853)
(AD-A053410; LC-78-B1) Avail: NTIS HC A04/MF A01 CSCL 21/8

This report documents findings on the non-operating reliability of silver zinc and thermal batteries. Field data and shelf life data are included. This information is part of a research program being conducted by the U.S. Army Missile R and D Command, Redstone Arsenal, Alabama. Author (GRA)

N78-29482# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
CONFIDENCE LIMITS ON MTBF FOR SEQUENTIAL TEST PLANS OF MIL-STD 781
Clifford M. Bryant and Joseph Schmee 15 Jan. 1978 40 p refs
(Contract N00014-77-C-0438)
(AD-A054588; AES-7805) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents tables for confidence limits on the MTBF of an exponential distribution using observations from sequential tests of MIL-STD 781. An example shows the use of the tables. The theory and calculation of the tables are explained in the Appendices. Author (GRA)

N78-29483# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
REPAIR MACHINING AND INSPECTION OF CRACKED COMPONENTS
E. A. B. deGraaf and R. J. H. Wanhill 21 Jun. 1977 20 p refs Submitted for publication. Sponsored by Directorate of Materiel Air, RNLAF
(NLR-MP-77018-U) Avail: NTIS HC A02/MF A01

Repair of fatigue cracked aluminum alloy specimens by machining is described. Several machining techniques were used in conjunction with various inspection methods. It is shown that a small part of the crack tip is often missed by post-machining inspection. Of the combinations of machining and inspection techniques the use of a hand held ball head burr plus fluorescent penetrant gave best results. Suggestions for further work are given. Author (ESA)

N78-29484# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
Guy E. Habercom, Jr. Apr. 1978 111 p 2 Vol.
(NTIS/PS-78/0358/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

A bibliography containing 106 abstracts concerning the fundamental principles of nondestructive testing and inspection, by use of infrared devices, is presented. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications researched. GRA

N78-29485# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
Guy E. Habercom, Jr. Apr. 1978 105 p 2 Vol.
(NTIS/PS-78/0359/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

A bibliography containing 90 abstracts concerning the fundamental principals of nondestructive testing and inspection, by use of infrared devices, is presented. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications researched. GRA

N78-29486# National Technical Information Service, Springfield, Va.
RELIABILITY: MATHEMATICAL TECHNIQUES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - May 1977
George W. Reimherr May 1978 300 p
(NTIS/PS-78/0438/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 14D

Topics covered include statistical analysis, fault tree analysis, life testing, failure analysis, and mathematical models as applied to reliability prediction. GRA

N78-29487# National Technical Information Service, Springfield, Va.
RELIABILITY: MATHEMATICAL TECHNIQUES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1977 - Apr. 1978
George W. Reimherr May 1978 45 p Supersedes NTIS/PS-77/0445; NTIS/PS-76/0221
(NTIS/PS-78/0439/6; NTIS/PS-77/0445; NTIS/PS-76/0221) Avail: NTIS HC $28.00/MF $28.00 CSCL 14D

For abstract, see N78-29486.

N78-29488# National Bureau of Standards, Washington, D. C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: AUTOMATED PHOTOMASK INSPECTION
Donald B. Novotny and Dino R. Ciarlo (Calif. Univ., Livermore) Apr. 1978 41 p refs
(ARPA Order 2397)
(PB-279336/2; NBS-SP-400-36; LC-78-606023) Avail: NTIS HC A03/MF A01 CSCL 13I

Methods analyzed for visual defect inspection are the optical-overlay; the dual-beam, flying-spot-scanner; the TV-microscope; and the spatial-filtering methods. For dimensional inspection, an analysis of line-edge location and operating criteria for the microdensitometer are presented. The fabrication of photomasks with intentionally introduced and controlled defects is described together with preliminary results of automated inspections of these photomasks. It is concluded that: automated inspection systems should be dedicated either to inspection for visual defects or dimensional compliance. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-29489 Technische Hochschule, Darmstadt (West Germany).
ELASTIC-PLASTIC CRACK CLOSURE ANALYSIS OF DUGDALE CRACK PLATES BASED ON FATIGUE FRACTURE MECHANICS
Heiner Fuehring 1977 267 p refs In GERMAN; ENGLISH summary
(Rept-30) Copyright. Avail: Issuing Activity

Cracked plates subjected to cyclic loading were analyzed by describing the elasto-plastic state of stress and displacement of material elements on the crack axis at each load reversal point. As an analytical approach the Dugdale-Baren-Blatt-(DB-) method was chosen which models the complex system in an extremely simple manner. The crack plate is treated two-dimensionally under plane stress conditions. When applying a special rule, the original elasto-plastic problem can be substituted by an equivalent system which is only elastic and has an additional crack surface loading case. Necessary conditions for utilization of the DB-method are: (1) the system belongs to the class of Dugdale problems, (2) its elastic field equations are known, (3) the stress-strain

law of the material element, and (4) a relationship between plastic strains and plastic deformations. F.O.S.

N78-29490 Illinois Univ. at Urbana-Champaign, Urbana.
DISCRETE STRUCTURAL OPTIMIZATION Ph.D. Thesis
Visarn Chanaratina 1978 200 p
Avail: Univ. Microfilms Order No. 7811218

Large classes of problems in structural design have inherently discrete design variables. A new technique is developed for solving discrete structural optimization problems. The optimization in structural design is formulated as a discrete constrained problem, and the interior penalty function is used to transform the constrained problem to a sequence of unconstrained problems. The discrete solution of each unconstrained problem is obtained by the method of integer gradient direction, and the sequence of these optima will converge to a discrete local optimum of the original constrained problem. The method is applied to the least weight design of steel building frames. The constraints include stress and stability constraints and the sidesway limitation. Both fixed and alternate loading conditions are considered. An example of the least cost design of a simple reinforced concrete beam is also presented. Dissert. Abstr.

N78-29491 Alabama Univ., University.
DYNAMIC RESPONSE OF A GEOMETRICALLY NONLINEAR ELASTIC/VISCOELASTIC CYLINDER Ph.D. Thesis
Alice Joyce Kerr Neighbors 1977 173 p
Avail: Univ. Microfilms Order No. 7809870

The dynamic analysis of an infinitely long circular composite cylinder with a viscoelastic core and a thin elastic case is considered. The thin elastic case serves as the principal load carrying structure while the viscoelastic core contributes mass and damping effects to the dynamic behavior. The cylinder is subjected to a uniform internal static pressure and an externally distributed impulse load. The kinematics of the deformation is assumed to include geometrical nonlinearities while the material properties are assumed to be linear. The symmetric Piola-Kirchoff stress tensor of the viscoelastic material is related to the Lagrangian strain tensor by a convolution integral. The memory effects of the viscoelastic material and the dynamic effects of the problem cause the response to be path dependent, dictating that an incremental formulation be used; the Lagrangian Incremental formulation is employed. The finite element method is employed to discretize the spatial response. Dissert. Abstr.

N78-29492 Marquette Univ., Milwaukee, Wis.
FINITE ELEMENT ANALYSIS OF ROTOR-BEARING SYSTEMS WITH MATRIX REDUCTION Ph.D. Thesis
Keith Edwin Rouch 1977 263 p
Avail: Univ. Microfilms Order No. 7810293

The finite element representation is extensively utilized in static and dynamic analysis of structural systems, and its impact on other numerical analysis is increasing. Application is made of the technique to dynamic analysis of rotor-bearing systems. The use of reduced stiffness, mass, and damping matrices to represent the shaft, in place of the complete global stiffness matrices, is explored. The basic element representations of rotating beam, disc, and bearing portions of the rotor are developed. The steady rotation about the rotor axis is shown to result in a skew symmetric gyroscopic damping matrix in addition to the usual beam stiffness and mass matrices. The direct use of shear strain as a nodal variable, followed by reduction to retain only displacement and slope degrees of freedom on an element or global basis, is described and implemented for a general tapered beam. Dissert. Abstr.

N78-29493 Pittsburgh Univ., Pa.
STRESS ANALYSIS OF A VISCOELASTIC MATERIAL IN THE CALENDERING PROCESS Ph.D. Thesis
Ming-Tong Yu 1977 186 p
Avail: Univ. Microfilms Order No. 7809968

The Maxwell model was used for representing a viscoelastic material in the calendering problem. The material to be processed was considered as isotropic, homogeneous, at constant temperature and in a state of plane strain. Approximate solutions for the stress field and velocity profiles were obtained. The gap exit was numerically evaluated. The total radial pressure and tangential shear along the contact surface furnished data for estimating rolling force and torque. Tables of the rolling forces and torque are provided. Two dimensionless parameters were determined that characterize the stress and velocity distributions in the rolling phenomenon of the viscoelastic distributions in the rolling phenomenon of the viscoelastic material. Curves and discussions are useful as criteria for design applications. Dissert. Abstr.

N78-29494 Illinois Univ. at Urbana-Champaign, Urbana.
PREDICTED EFFECTS OF RESIDUAL STRESSES ON BUTT WELD FATIGUE LIFE Ph.D. Thesis
James Darnell Burk 1978 127 p
Avail: Univ. Microfilms Order No. 7811214

A model was developed which predicts the influence of residual stress and stress ratio on the total fatigue life of a weld. The total fatigue life of a weld was considered to be composed of both crack initiation and crack propagation. Residual stresses were considered to influence the crack initiation life but not the crack propagation life. The crack initiation life was estimated by a damage integral method developed from cumulative damage concepts. Actual weld material properties (weld metal and heat effected zone) were considered in the initiation life estimation. Neuber's rule was used to determine the local cyclic stress-strain behavior at the weld toe, and the fatigue notch factor was evaluated using Peterson's equation. Residual stresses were introduced into the analysis as a simulated prestressing of the weld. Relaxation of the mean stress established during the set-up cycle was modeled by a power function and allowed relaxation to be considered in life estimates. Dissert. Abstr.

N78-29495 Aeronautical Research Labs., Melbourne (Australia).
AN ULTRASONIC PULSE-HEIGHT DIFFERENCE METHOD OF RECORDING CRACK GROWTH OVER AN EXTENDED PERIOD
W. J. Pollock and A. J. Farrell Sep. 1977 26 p refs
(ARL/Mat-Note-120; AR-000-120) Copyright. Avail: Issuing Activity

A method for recording slow crack growth, using a conventional ultrasonic tester and chart recorder, is described. The problems caused by changes in the measuring system over long periods were overcome by relating crack growth to the amplitude difference between the crack reflection and a reference reflection. Some applications of the technique are described. Author

N78-29496 Lehigh Univ., Bethlehem, Pa.
FINITE ELEMENTS FOR THE ELASTIC ANALYSIS OF COMPOSITE BEAMS AND BRIDGES Ph.D. Thesis
Stephen Charles Tumminelli 1978 202 p
Avail: Univ. Microfilms Order No. 7808081

Formulations are presented for general finite elements which can be used to perform elastic analyses of composite single or multibeam, simple or continuous bridge superstructures. The most sophisticated element can include the effects of slip between the bridge deck and the beams, shear deformations in the beams and shear lag in the deck. The formulations begin by assuming internal displacement fields. The compatibility at the nodes and constraining equations between the fields are applied to solve for the displacement field coefficients. Finally, the element stiffness matrix is formulated via the application of the principle of virtual work. Dissert. Abstr.

N78-29497# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE TESTS ON I-BEAMS OF STEEL ST 52-3
R. Olivier 1978 28 p refs In GERMAN; ENGLISH summary
(FB-91; ICAF-1013) Avail: NTIS HC A03/MF A01

I-beams that were obtained by welding 8 mm and 10 mm thick plates of the steel St 52-3 containing about 0.17% C, 0.3%Si, 1.2% Mn, 0.027% p, 0.025%S, and 0.03% Al were subjected to reverse bending fatigue tests to determine the fatigue strength. Fillet welds were executed, partly by manual welding with electrode, and partly by automatic gas envelope welding. Butt seams on flanges and webs always were welded manually. In no case, cracks originated from seam crossings. Provided that flange butt welds were free from crack determining defects, fatigue cracks preferentially proceeded from the toes of fillet welds.
F.O.S.

N78-29498# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
HANDLING OF FATIGUE DATA IN COMPUTER ANALYSIS
R. Fischer and U. Wendt 1978 25 p refs
Avail: NTIS HC A02/MF A01

A program system called FATIMA developed for the easy handling of fatigue data for later computer analysis is described. The basic idea of its realization was to specify a standard format for data input and to use that standard also for file storage and data processing. The organization and the functions of FATIMA were explained with particular emphasis on six autonomous program routines designed for the input, the correction, the modification, the transfer, the retrieval and the selection of individual or grouped sets of data for processing. Each of these program routines is provided with extensive dialogue capabilities for easy application even by users less familiar with the details of the design philosophy of FATIMA. B.B.

N78-29499# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
LOW CYCLE-FATIGUE AND FRACTURE BEHAVIOUR AS PARAMETERS FOR THE DIMENSIONING OF HIGH PRESSURE VESSELS
Vatroslav Grubisic 1977 6 p refs Repr. from FhG-Ber. (West Ger.), no. 3, 1977 p 13-17 In GERMAN; ENGLISH summary
(ICAF-1012) Avail: NTIS HC A02/MF A01

The behavior under cyclic elastic and plastic deformations, the crack propagation, and the brittle fracture of a high-pressure vessel steel with different values for ultimate strength and yielding point are discussed and their application for the dimensioning in the low-cycle fatigue range presented. F.O.S.

N78-29500# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE STRENGTH OF A FIBRE-REINFORCED MATERIAL
D. Schuetz and J. J. Gerharz Oct. 1977 7 p Repr. from Composites (Engl.), 8, no. 4, 1977 p 245-250 Presented at SEE Fatigue Group Conf. on Fatigue of FRP, London, 29 Jun. 1977 Submitted for publication
Avail: NTIS HC A02/MF A01

The constant and variable amplitude fatigue strengths, and the tensile and compressive strengths of Carbon Fiber Plastic reinforcement were determined. Unnotched specimens of carbon/HT fiber in an epoxy matrix were used in the form of multi-ply 0 deg, + or - 45 deg and 90 deg laminates. Results of constant amplitude tests for the stress ratios +0.1 -0.5,-1.0,-1.66 and -5.0 are presented. Variable amplitude tests were carried out using a flight-by-flight loading sequence typical for the wing root area of fighter aircraft. Calculated life and test results are compared and the influence of loading modifications examined with regard to the high and low load cycle ranges of the load spectrum. The fatigue behavior of the composite material is compared with that of metals. F.O.S.

N78-29501# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
COMPUTATION OF THE IRREGULARITY-FACTOR N SUB O/N SUB 1 OF A STATIONARY GAUSSIAN PROCESS WITH DUAL PEAK POWER SPECTRAL DENSITY
E. Haibach and U. Wendt 1977 35 p refs In GERMAN; ENGLISH summary
(TB-137; ICAF-1039) Avail: NTIS HC A03/MF A01

A Gaussian random signal for which the power spectral density function shows a dual peak can be produced by means of two bandpass filters and two random signal generators. The irregularity factor of such signals was computed for typical filter characteristics as a function of the distance of the peak center frequencies. The results obtained for different values of the relative bandwidths, of the attenuation and of the intensity of the two bandpass signals are shown in diagrams. The attainable variations of the irregularity factor are discussed with reference to applications in random fatigue testing. G.Y.

N78-29502# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
RATE THEORY OF A TWO-DIMENSIONAL ELASTO-PLASTIC CONTINUUM
Menahem Baruch and David Durban May 1977 31 p refs (TAE-303) Avail: NTIS HC A03/MF A01

An adaption of a three dimensional rate elasto-plastic theory for two dimensional plane domains is proposed. Two basic cases are treated: (1) plane deformation in which no displacement is permitted in the direction perpendicular to the plane of deformation, and (2) plane stress in which the components of the stress tensor connected with the direction perpendicular to the plate are supposed to be zero. Additional assumptions needed for this case are also proposed. Author

N78-29503*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
THEORETICAL-EXPERIMENTAL CORRELATION FOR BUCKLING OF COMPOSITE CYLINDERS UNDER COMBINED COMPRESSION AND TORSION Final Report
Herakovich Jul. 1978 122 p refs
(Contract NAS1-13175)
(NASA-CR-157358; VPI-E-78-14) Avail: NTIS HC A06/MF A01 CSCL 20K

Comparison between theory and experiment for buckling of laminated graphite-epoxy and boron-epoxy cylinders under combined compression and torsion are presented. The experimental results are compared to a theory by Wu. It is shown that there is excellent agreement between theory and experiment for pure torsional loading (positive and negative), experimental buckling loads for pure compression are well below the predicted values, and good correlation is exhibited between theory and experiment for buckling under combined loading when compared in the form of normalized buckling interaction diagrams in axial-torsional load space. Author

N78-29504# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE METHOD OF MAXIMUM LIKELIHOOD APPLIED TO THE STATISTICAL ANALYSIS OF FATIGUE DATA INCLUDING RUN-OUTS
J. E. Spindel (British Railways Board, London) and E. Haibach 1978 24 p refs Presented at SEE Intern. Conf.: Appl. of Computers in Fatigue, Coventry, 3-6 Apr. 1978 p 7.1-7.23
(ICAF-1036) Avail: NTIS HC A02/MF A01

The application is described of the principle of maximum likelihood to the analysis of fatigue test results including run-outs. The particular method used is that developed by Edwards and called by him the method of support. The use of this method is described in determining means and standard deviations for test results, the determination of best-fit S-N curves with their associated standard deviations and the determination of the significance of differences between groups of results, different S-N curves and the determination of best common slopes and intercepts of such curves. A computer program is presented which was developed to perform the necessary calculations. Examples are given of the types of results produced by this analysis and of certain difficulties in interpretation. F.O.S.

N78-29505*# National Aeronautics and Space Administration, Washington, D. C.
THE NASTRAN PROGRAMMER'S MANUAL (LEVEL 16.0)
Jul. 1976 3444 p
(NASA-SP-223(03)) Avail: NTIS HC A99/MF A01 CSCL 20K

A general overview of the NASTRAN computer program is given. Elements of the program described include: (1) the data blocks, which are the principal means of data communication between the program's functional modules and the NASTRAN Executive System; (2) tables, both core and noncore resident, maintained by the NASTRAND Executive System and miscellaneous tables which are accessed by a class of modules; (3) utility or general purpose subroutines and modules of NASTRAN; (4) computer and operating system dependent matters such as operating system control cards and generation of the absolute NASTRAN system; (5) implementation of modifications and additions to NASTRAN; and (6) auxiliary programs used to maintain or interface with NASTRAN. Indexes for the data block and table descriptions and the module functional descriptions are included along with a dictionary of mnemonics, acronyms, phrases, and 'buzz' words peculiar to NASTRAN. J.M.S.

N78-29506*# National Aeronautics and Space Administration, Washington, D. C.
THE NASTRAN USER'S MANUAL: LEVEL 16.0 SUPPLEMENT
Jul. 1976 1240 p refs
(NASA-SP-222(03)) Avail: NTIS HC A99/MF A01 CSCL 20K

The user's manual is restricted to those items related to the use of NASTRAN that are independent of the computing system being used. The features of NASTRAN described include: (1) procedures for defining and loading a structural model and a functional reference for every card that is used for structural modeling; (2) the NASTRAN data deck, including the details for each of the data cards; (3) the NASTRAN control cards that are associated with the use of the program; (4) rigid format procedures, along with specific instructions for the use of each rigid format: (5) procedures for using instructions for the use of each rigid format; (5) procedures for using the NASTRAN plotting capability; (6) procedures governing the creation of DMAP programs; and (7) the NASTRAN diagnostic messages. The NASTRAN dictionary of mnemonics, acronyms, phrases, and other commonly used NASTRAN terms is included along with a limited number of sample problems. J.M.S.

N78-29507# Naval Postgraduate School, Monterey, Calif.
SHOCK INDUCED STRUCTURAL RESPONSE M.S. Thesis
Jose Gonzales Gallo Mar. 1978 60 p refs
(AD-A053877) Avail: NTIS HC A04/MF A01 CSCL 13/13

An infinitely long, ring-stiffened, submerged, elastic cylinder having uniformly spaced elastic bulkheads is the structure considered. Loading is applied by a plane acoustic shock wave with front parallel to the cylinder axis. Dynamic pressure in the fluid is resolved into a free-field incident part and a scattered part. Structural response and scattered pressure in the surrounding fluid are found using finite element modeling of structure and fluid. Introduction of Fourier series makes the fluid region mathematically two-dimensional. A radiation, or non-reflecting, condition at the outer boundary of the fluid region is shown to give good results. A parametric study is made of effects of shock pulse rise time and duration on structural response. Results are presented as combinations of shock pressure and submergence pressure just sufficient to induce structural failure. Author (GRA)

N78-29508# Illinois Inst. of Tech., Chicago.
SOME INVESTIGATIONS RELATING TO THE ELASTOSTATICS OF A TAPERED TUBE Final Report, 21 May - 26 Aug. 1977
Barry Bernstein Mar. 1978 38 p
(Contract DAAG29-76-D-0100)
(AD-A054330; AD-E430011) Avail: NTIS HC A03/MF A01 CSCL 20/11

Separation of variables for the harmonic and biharmonic is not possible for the coordinate system describing a tapered hollow cylinder so alternative methods are required. The method of characteristics, Poisson integral representations, series in two coordinate variables, and the method of successive approximations are discussed in some detail. The only method to show promise for future work is the method of successive approximations used by A. Zak to investigate singularity stresses at the end of a cylinder. Author (GRA)

N78-29509# Lockheed-California Co., Burbank.
FRACTURE MECHANICS FOR STRUCTURAL ADHESIVE BONDS Final Report, 15 Jun. 1975 - 15 Jul. 1977
T. R. Brussat, S. T. Chiu, and S. Mostovoy Oct. 1977 125 p refs
(Contract F33615-75-C-5224)
(AD-A054023; LR-28196; AFML-TR-77-163) Avail: NTIS HC A06/MF A01 CSCL 11/1

Tests and analyses were conducted to develop and demonstrate the fracture mechanics methodology to predict the growth of bondline flaws in adhesively bonded primary aircraft structure. The development and use of a new baseline specimen for testing bondline cracks in combined Modes I and II is described. Specimen development work on other adhesive fracture mechanics specimens including modes I and III is described. Fracture mechanics data for AF-55S adhesive are presented covering fatigue, sustained and monotonically increasing loading, in laboratory air and hot water, in Pure Mode I, and mixed Modes I and II. Adhesive bondline crack growth data are presented from fatigue tests of larger structural bonded single lap joints with initial bondline flaws. Techniques are demonstrated for growth monitoring both ultrasonically and by a compliance technique. A fracture mechanics analysis estimate of bondline crack growth rates in these tests is described, and the estimated rates are compared to the actual monitored crack growth rates. Based on this work an evaluation is made of fracture mechanics methodology as applied to bondline cracks in adhesively bonded aircraft structure. Author (GRA)

N78-29510# Argonne National Lab., Ill.
VIBRO-IMPACT RESPONSES OF A TUBE WITH TUBE-BAFFLE INTERACTION
Y. S. Shin, D. S. Sass, and J. A. Jendrzejczyk Jan. 1978 75 p refs
(Contract W-31-109-eng-38)
(ANL-CT-78-11) Avail: NTIS HC A04/MF A01

The relatively small, inherent tube-to-baffle hole clearances associated with manufacturing tolerances in heat exchangers affect the vibrational characteristics and the response of the tube. Numerical studies were made to predict the vibro-impact response of a tube with tube-baffle interaction. The finite element method was employed with a non-linear elastic contact spring-dashpot to model the effect of the relative approach between the tube and the baffle plate. The coupled equations of motion are directly integrated with a proportional system damping represented by a linear combination of mass and stiffness. Lumped mass approach with explicit time integration scheme was found to be a suitable choice for tube-baffle impacting analysis. Fourier analyses indicate that the higher mode contributions to the tube response are significant for strong tube-baffle impacting. The contact damping forces are negligible compared with the contact spring forces. The numerical analysis results are in reasonably good agreement with those of the experiments. ERA

N78-29511# Missouri Univ., Rolla. Rock Mechanics and Explosives Research Center.
INELASTIC BENDING OF BEAMS UNDER TIME-VARYING MOMENTS: A STATE VARIABLE APPROACH
Kaung Jain Chang (Cornell Univ., Ithaca, N. Y.), Richard H. Lance (Cornell Univ., Ithaca, N. Y.), and Subrata Mukherjee Jan. 1978 27 p refs
(Contract EY-76-S-02-2733)
(COO-2733-15) Avail: NTIS HC A03/MF A01

The inelastic response of a beam to several time-varying moments is presented. The constitutive equations used to describe the beam material are due to Hart. This is one of several state variable theories of inelastic deformation that were proposed recently. Hart's equations were previously shown to accurately predict the response of uniaxial specimens to time-varying loads. It is seen that Hart's theory is able to qualitatively simulate various phenomena in creep and plasticity such as the effect of previous deformation history, yielding, strain recovery, material hardening and strain rate sensitivity in this case of bending of a beam. The computational scheme used to integrate the equations is very efficient. ERA

N78-29512# California Univ., Livermore. Lawrence Livermore Lab. Methods Development Group.
COMPUTER MODULE FOR ONE STEP DYNAMIC RESPONSE OF AN AXISYMMETRIC OR PLANE LINEAR ELASTIC THIN SHELL
G. L. Goudreau Feb. 1978 17 p refs
(Contract W-7405-eng-48)
(UCID-17730) Avail: NTIS HC A02/MF A01

A computer subprogram is offered as a module for coupling an axisymmetric or plane linear elastic thin shell to two-dimensional fluid or solid continuum codes. Given the current geometry and particle velocities and new interface pressures, the subprogram computes the new geometry and particle velocities. The method is based upon the unconditionally stable Newmark or trapezoidal method of implicit time integration. The shell formulation is taken from the thin shell theory of Kraus with shear deformation. The finite element formulation utilizes piecewise linear expansions of membrane and transverse displacements as well as the rotation. Utilizing the one point

quadrature of Hughes, the method is accurate in the thin shell limit. ERA

N78-29513# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

EFFECTS OF GEOMETRIC NONUNIFORMITIES ON THE STRESSES IN PIPING ELBOWS

Kevin Thomas and D. S. Griffin Jan. 1978 76 p refs

(Contract EY-76-C-02-3045-032)

(WARD-SD-3045-7) Avail: NTIS HC A05/MF A01

A comparative evaluation is presented of the effects of thickness variation, initial ovality, intrados wrinkling and longitudinal weld shrinkage on thin walled elbow stresses under pressure and inplane moment loadings. The comparison identifies the nonuniformities of greatest significance and provides a basis for evaluation of the code method of determining stress indices for the case of initial ovality. The analysis method and analytical models developed using the STAGS program are described. The results for each of the nonuniformities investigated are presented. ERA

N78-29514# Los Alamos Scientific Lab., N. Mex.

STRUCTURAL DESIGN FOR A 10-GWh SMES VACUUM VESSEL

J. G. Bennett and C. A. Anderson Jan. 1978 36 p refs

(Contract W-7405-eng-36)

(LA-7110-MS) Avail: NTIS HC A03/MF A01

An approximate solution to the problem of the nonlinear elastic deformation of a periodically point supported cylindrical shell was obtained. The solution was used to investigate the structural design of the vacuum vessel for the large underground (SMES) superconducting magnetic energy storage concept. Vacuum vessel designs are evaluated by varying such parameters, as shell thickness, support spacing, material properties and physical configuration to keep the amount of material used and construction cost to a minimum. ERA

N78-29515# Bettis Atomic Power Lab., West Mifflin, Pa.

HYDRAULIC PRESSURE PULSES WITH ELASTIC AND PLASTIC STRUCTURAL FLEXIBILITY: TEST AND ANALYSIS (LWBR DEVELOPMENT PROGRAM)

R. E. Schwirian Mar. 1978 65 p refs

(Contract EY-76-C-11-0014)

(WAPD-TM-1375) Avail: NTIS HC A04/MF A01

Pressure pulse tests were conducted with a flexible test section in a test vessel filled with room temperature water. The pressure pulses were generated with a drop hammer and piston pulse generator and were of a sufficient magnitude to cause plastic deformation of the test section. Because of the strong pressure relief effect of the deforming test section, pressure pulse magnitudes were below 265 psig in magnitude and had durations of 50 to 55 msecs. FLASH 35 adequately predicts the decrease in peak pressure and the increase in pulse duration due to elastic and plastic deformation of the test section. Predictions of flexible member motion are good, but are less satisfactory than the pressure pulse results due to uncertainties in the values of yield point and beyond yield stiffness used to model the various flexible members. ERA

N78-29516# Research Inst. of National Defence, Stockholm (Sweden).

FINITE ELEMENT ANALYSIS OF AIR PULSE WAVE LOADED SINGLE THROWN CONCRETE PLATES [ANALYS MED FINIT ELEMENTMETOD AV LUFTSTOETV-AAGSBELASTADE, ENKELSPAENDA BETONGPLATTOR]

Larsgunnar Nilsson (Chalmers Univ. of Technol., Goteborg) and Ingemar Johansson Nov. 1977 72 p refs In SWEDISH

(FOA-C-20204-D4(A3)) Avail: NTIS HC A04/MF A01

A finite element method was developed for dynamic structural analysis. Earlier development was aimed mainly at linear problem analyses, but now even several nonlinearities can be considered. The method is potentially suited for analysis of air pulse wave loaded concrete constructions. A two-dimensional calculation model for analysis of reinforced concrete constructions under plane stress is presented. Results of the calculations are compared with experimental results. In most cases these results coincide well. The calculations give rise to several ideas to further develop the calculation model. The finite element method is likely to become a very useful tool in thorough analysis of air pulse wave loaded concrete constructions. Author (ESA)

N78-29517# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.

THE DEFORMATION OF STEEL BARS IN A FOUR-POINT BENDING MACHINE, MEASURED BY HOLOGRAPHIC INTERFEROMETRY

E. Archbold, A. E. Ennos, and M. S. Virdee Dec. 1977 21 p refs

(NPL-MOM-27) Avail: NTIS HC A02/MF A01

The manner in which standard steel bars deform when subjected to loading in a four-point bending machine was investigated by holographic interferometry. Using this method the profile change that takes place for a small increment of load can be evaluated accurately in terms of the wavelength of light without contacting the bar in any way. It was shown that the bending along the axis of the bar was accurately circular over the complete loading range but that asymmetry occurs for very small loads and for uneven loading of the central carriage of the machine. An apparent stiffening of the bar as the load increased to its maximum was attributed partly to the geometry of loading and partly to friction in the bearings. The significance of these effects in the use of the machine for the long term testing of strain gages, which are to be bonded to the steel bars, is discussed. Author (ESA)

N78-29518# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

MICROSCOPIC STUDY OF STRESS CORROSION CRACK GROWTH IN AN AlZnMg ALLOY

L. Schra and H. P. vanLeeuwen Feb. 1977 23 p refs Presented at the GARTEUR 3 Meeting, Cologne, 10 Nov. 1976

(NLR-MP-77004-U) Avail: NTIS HC A02/MF A01

The tip of a growing stress corrosion crack was photographed at a magnification of 72 x and at 30 sec intervals. The crack appeared to grow in a discontinuous manner. Crack reinitiation was preceded or accompanied by gas evolution. Author (ESA)

N78-29519# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

BEHAVIOUR OF PIERCED AND CRACKED PLATES LOADED BEYOND GENERAL YIELD

Rudi Denys (Belg. Inst. of Welding) Oct. 1977 29 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.

(CRIF-MT-119) Avail: NTIS HC A03/MF A01

The influence of cracks at an opening was investigated. The overall elongation and the local deformation at the crack tips were measured in order to get a good idea of geometrical influence. In addition, plastic behavior at low temperature and at room temperature were studied. With regard to fracture, overall ductility is an important parameter. Overall ductility takes into account influence parameters such as plate thickness and temperature. An overall ductility of 1% seems to be a conservative figure in terms of safety. Two series of twelve specimens were statically tested up to fracture. The first series were carried out at room temperature, the second series at -30 C. Test results provide a clear insight into the influence of an opening, the length of the cracks, and the temperature on specimens loaded in tensile. Author (ESA)

N78-29520# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

EXTERNAL LOADINGS ON NOZZLES IN CYLINDRICAL SHELLS

Joris Decock Mar. 1978 50 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.

(CRIF-MT-122) Avail: NTIS HC A03/MF A01

All results obtained from an elastic stress analysis by strain-gages on two different pressure vessels, each provided with a nozzle, are summarized. Seven different cases of loadings (external loading with or without internal pressure) were applied. For one vessel a comparison could be made with existing design methods; from this comparison it is clear that actual design methods are extremely conservative. Author (ESA)

N78-29521# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
AN EXPERIMENTAL TECHNIQUE FOR VACUUM INFILTRATION OF CRACKS WITH PLASTIC AND SUBSEQUENT STUDY IN THE SCANNING ELECTRON MICROSCOPE
C. Q. Bowles Jun. 1977 20 p refs
(VTH-LR-249) Avail: NTIS HC A02/MF A01

A new technique of insitu vacuum infiltration with plastic to produce a casting of the crack is described. The reason for developing the technique is based on the fact that fracture surface studies (TEM or SEM) can only speculate about events occurring at the crack tip. In contrast, although a new sample is used for each infiltration, plastic castings allow the experimenter to study fracture events occurring at the crack tip at any particular point during the load cycle. Author (ESA)

N78-29522# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE TESTING OF TRANSVERSELY LOADED ALUMINIUM LUGS, SEQUENCE 2
Nils Larsson 1978 31 p ref
(Contract FMV-FK-82223-75-007-001)
(FFA-TN-HU-1848) Avail: NTIS HC A03/MF A01

A sequence of fatigue testing of pinned lugs of forged aluminum AZ 74 is presented. The tests comprised loading in the directions phi equals 30, 60, 90, and 110 deg to the principal axis of the lug. Loading was applied as alternating tension with Pmin = 500 N, for lugs type A 1 also P mean = 0. Testing results from the whole investigation are revised to diagrams showing fatigue strength versus loading direction. A general tendency seems to be unchanged strength from phi = 0 deg to phi = 30 deg, a slight reduction about phi = 60 deg and then a steady increase; the fatigue strength at phi = 90 deg in most cases better then at phi = 0 deg. Author (ESA)

N78-29523# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
VISCOELASTIC BUCKLING OF SHELLS
Silvio Merazzi (Ecole Polytech. Federale de Lausanne, Switz.) and Peter Stehlin 1978 15 p refs
(Contract FMV-FK-82223-75-083-07-001)
(FFA-TN-HU-1911) Avail: NTIS HC A02/MF A01

The viscoelastic creep collapse of thin parabolical shell structures was investigated. The shells were subjected to external pressure and their time-displacement history was recorded in order to study the development of the buckling pattern and the influence of initial imperfections. The test setup is explained, and it is shown how material properties, shell geometry, and initial imperfections were determined. Techniques used for measuring the buckling deformation and the collapse time are detailed. Author (ESA)

N78-29524# European Space Agency, Paris (France).
NONLINEAR DEFORMATIONS AND STATIC BUCKLING
Roger Valid Jun. 1978 117 p refs Transl. into ENGLISH of 'Deformations Non Lineaires et Flambage Statique', ONERA, Paris Report ONERA-P-1977-2, 1977 Original report in FRENCH previously announced as N78-24590
(ESA-TT-478; ONERA-P-1977-2) Avail: NTIS HC A06/MF A01

Recapitulating some variational formulations and discretized methods, new results are provided, in particular in the field of the large displacements shell theory. The classical perturbation method was applied in the study and discussion of buckling and post-buckling, but by means of systematic methods, some aspects of which are original. The case of multi-bifurcation points was examined and a discussion of their stability is touched upon. Author (ESA)

N78-29525# Clemson Univ., S.C. Dept. of Mechanical Engineering.
USERS' MANUAL FOR KALKER'S SIMPLIFIED NONLINEAR CREEP THEORY Interim Report
James G. Goree and E. Harry Law Dec. 1977 58 p refs Prepared in cooperation with Arizona State Univ., and Association of Am. Railroads
(Contract DOT-OS-40018)
(PB-279503/7; FRA/ORD-78/06) Avail: NTIS HC A04/MF A01 CSCL 13F

The conversion of the computer program, Simplified Theory of Rolling Contact, (used for calculation of a nonlinear creep force-creepage relationship) from the original ALGO language to FORTRAN is considered. A significant number of changes was made in the program for more convenient use; however, the fundamental equations remain unchanged. The program gives an appropriate solution for the resultant tangential creep forces and spin moment acting between two bodies of equal linearly elastic material properties. GRA

N78-29526# North Carolina State Univ., Raleigh. Highway Research Program.
COMPUTATION OF TENSILE STRESS IN PRESTRESSED MEMBERS DUE TO CABLE RESTRAINT DURING DETENSIONING Final Report, May - Dec. 1977
J. F. Mirza and M. E. Tawfik Jan. 1978 44 p refs Sponsored in part by Federal Highway Admin. and North Carolina Dept. of Transportation and Highway Safety
(PB-279391/7; ERSD-110-77-3; FHWA-RD-78-S0701) Avail: NTIS HC A03/MF A01 CSCL 13M

A computer program is developed that will assist in the computation of tension stress due to cable restraint during detensioning, the primary cause of the end cracks. In addition when high tensile stress is unavoidable rational procedures for sheathing some of the cables to reduce tension are described. A parametric study indicates that this tensile stress is of permissible magnitude when the ratio of the length of the cable at each end to the casting bed length is 5 percent or higher. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-29527 Georgia Inst. of Tech., Atlanta.
HYDROLOGIC SIMULATION IN A SEMI-ARID REGION Ph.D. Thesis
Adnan Ahmad Saad 1978 259 p
Avail: Univ. Microfilms Order No. 78-10864

The objective was to develop a watershed simulation model which would reproduce the essential features of the hydrologic regime of a semi-arid region such as Jordan. The Jordan Watershed Model is intended to replace the empirical methods presently being used in simulating streamflow records for wadis where water resources development projects are planned. The procedure of conducting the research was to collect all available information on soils, geology, topographic maps, rainfall, streamflow, evaporation, and previous studies by various agencies and consultants. The rainfall and the streamflow data were screened and analyzed to get an insight into the major hydrologic and the seasonal characteristics. A continuous streamflow simulation model was formulated based on the findings of the above analyses and the availability of data on the meteorological and the physical characteristics of the region. Dissert. Abstr.

N78-29528 State Univ. of New York at Buffalo.
MODEL STUDIES OF LAKE ERIE Ph.D. Thesis
Kwang-Hwa Andrew Yu 1978 128 p
Avail: Univ. Microfilms Order No. 78-10677

A distorted physical model of Lake Erie was used to study the circulation and mixing phenomena in the lake during cold and warm seasons. The model, which was constructed with a

horizontal scale ratio of 1:100,000 and a vertical scale ratio of 1:250, was operated in accordance with Froude Law requirements, and rotated to include the effects of the earth's rotation. Aspects examined include the circulation pattern, the flushing characteristics in the model lake with and without prevailing wind, and the fate of selected tributaries. Frictional calibration was accomplished through analysis of the decay of seiche motion. The effect of stratification on the circulation and mixing behavior was examined. The experimentally observed circulation pattern was compared with numerically computed currents and with prototype observations. A semi-empirical axial-dispersion model was developed to incorporate the flushing experiment results. Dissert. Abstr.

N78-29529# British Library Lending Div., Boston Spa (England).
USING A 70-mm STEREO CAMERA SYSTEM WITH LARGE-SCALE PHOTOGRAMMETRIC INTERPRETATION FOR FOREST INVENTORY
B. Rhody 1 Nov. 1977 15 p refs Transl. into ENGLISH from Forstarchiv (West Germany), 48, 4, 1977 p 65-70 In ENGLISH and GERMAN
(FCT-492) Avail: British Library Lending Div., Boston Spa, Engl.

Large scale 70 mm picture format photogrammetry of forests in northern Germany were obtained by using two stereocameras in an aluminum housing installed 4 to 5 m apart on the wing struts of a light aircraft, and a motor-driven small image camera for taking series photographs with stereo overlap. The two cameras were synchronously operated by means of a cable with a simultaneous triggering instrument actuated by the photographer in the aircraft. Measurement data based on the photogrammetric evaluation of the aerial photos are compared with ground data measured on the same sample plots using 35 mm wide angle overview photos. Standard errors in tree height measurement, stem diameters, crown diameters and volume estimates are discussed as well as methods for photointerpretation and data processing. A.R.H.

N78-29530 Texas Univ., Austin.
REMOTE SENSING OF THE EARTH'S ATMOSPHERE BY THE USE OF RADIATION FROM OZONE, OXYGEN AND WATER VAPOR Ph.D. Thesis
Alireza Afrashteh 1977 183 p
Avail: Univ. Microfilms Order No. 7807251

Using computer technique computation of absorption coefficient, opacity and emission due to the atmospheric ozone, oxygen and water vapor is performed. Some features like effect of antenna beam width and refraction on emission measurement are discussed. A technique for remote sensing of atmospheric ozone via satellite is proposed. The estimation of ozone density is performed by determining the parameters of an assumed model for ozone density. The parameters are determined by minimizing the difference between calculated and measured ozone emission profile (in 100 GHZ region). The observation base is assumed to be the space shuttle. Based on our results, recommendations for the best possible way to do the ozone emission measurement, for estimation of its density are given. Dissert. Abstr.

N78-29531*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Apr. - Jun. 1978
R. A. Halliday, Principal Investigator and I. A. Reid Jul. 1978 8 p Sponsored by NASA ERTS
(E78-10174; NASA-CR-157269) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. The project continued to demonstrate the feasibility of transmitting hydrometric data in the LANDSAT and GOES mode and using these data operationally. All elements except for the GOES downlink at PASS were functioning well.

N78-29532*# Texas A&M Univ., College Station. Remote Sensing Center.
MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Apr. 1977 - 1 Jun. 1978
Bruce J. Blanchard, Principal Investigator 1 Jun. 1978 110 p ERTS
(Grant NsG-5134)
(E78-10176; NASA-CR-157271; RSC-3458-2) Avail: NTIS HC A06/MF A01 CSCL 08M

The author has identified the following significant results. Repeated looks at surfaces that maintain constant roughness can provide an estimate of soil moisture in the surface, when appropriate radar look angles are used. Significant influence due to differences in soil moisture can be detected in the 13.3 GHz and 1.6 GHz scatterometer returns. Effects of normal crop densities have little influence on the surface soil moisture estimate, when appropriate look angles are used. It appears that different look angles are optimum for different frequencies to avoid effects from vegetation. Considering the frequency and look angles used on the Seasat-A imaging radar, differences in soil moisture should produce as much as 9 db difference in return on that system.

N78-29533*# Stanford Univ., Calif. School of Earth Sciences.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator Jul. 1978 2 p ERTS
(Contract NAS5-24479)
(E78-10177; NASA-CR-157272) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N78-29534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF THE DYNAMICS OF SHIFTING CULTIVATION IN THE TROPICAL FORESTS OF NORTHERN THAILAND USING LANDSAT MODELING AND CLASSIFICATION OF LANDSAT IMAGERY
Lee D. Miller, Kaew Nualchawee (Colorado State Univ.), and Craig Tom, Principal Investigators (HRB-Singer, Inc., Ft. Collins, Colo.) May 1978 20 p refs Presented at the 12th Intern. Symp. on Remote Sensing of Environment, Manila, Phillipines, 20-28 Apr. 1978 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10178; NASA-TM-79545) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N78-29535*# National Aeronautics and Space Administration, Washington, D. C.
SOYUZ 22: NEW CONTRIBUTION TO EARTH STUDY FROM SPACE
L. A. Vedeshin, V. V. Ivanov, and Ye D. Sulidi-Kondratyev Oct. 1977 9 p Transl. into ENGLISH from Priroda (USSR), no. 3, Mar. 1977 p 20-23 Original language doc. announced as N77-28559 Original doc. Prep. by Interkosmos Council, Academy of Sciences, USSR Transl. by Transemantics, Inc., Washington, D. C.
(Contract NASw-2792)
(NASA-TM-75055) Avail: NTIS HC A02/MF A01 CSCL 05B

The mission of space flight Soyuz-22 was to develop new and improved methods and means for finding tthe Earth's natural resources from outer space to aid the economy. With the help of the new multispectral space camera, MKF-6, the cosmonauts were able to photograph selected areas of U.S.S.R. and the German Democratic Republic in 4 visible and 2 infrared regions of the spectrum. The MKF-6 can simultaneously photograph areas in 6 spectral regions and register both the natural electromagnetic radiation of surface objects and the solar radiation reflected by them. L.S.

N78-29536*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF WAVELENGTH GROUPS FOR DISCRIMINATION OF AGRICULTURAL COVER TYPES
Ravindra Kumar Apr. 1978 13 p refs Submitted for publication
(Grant NGL-15-005-112)
(NASA-CR-157393; INPE-1210-PE/120) Avail: NTIS HC A03/MF A01 CSCL 02C

Multispectral scanner data in twelve spectral channels, in the wavelength range 0.46 to 11.7 mm, acquired in July 1971 for three flightlines, were analyzed by applying automatic pattern recognition techniques. These twelve spectral channels were divided into four wavelength groups (W1, W2, W3 and W4), each consisting of three wavelength channels -- with respect to their estimated probability of correct classification (P sub c) in discriminating agricultural cover types. The same analysis was also done for the data acquired in August, to investigate the effect of time on these results. The effect of deletion of each of the wavelength groups on P sub C in the subsets of one to nine channels, is given. Values of P sub C for all possible combinations of wavelength groups, in the subsets of one to eleven channels are also given. Author

N78-29537*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECTS OF SYSTEMIC AND NON-SYSTEMIC STRESSES ON THE THERMAL CHARACTERISTICS OF CORN
Ravindra Kumar, L. F. Silva, and M. E. Baer (Purdue Univ.) Jun. 1978 33 p refs Submitted for publication
(Grant NGL-15-005-112)
(NASA-CR-157391; INPE-1282-PE/138) Avail: NTIS HC A03/MF A01 CSCL 02C

Experiments were conducted on corn plants using a calibrated spectroradiometer under field conditions in the indium antimonide channel (InSb, 2.8 to 5.6 mm) and the mercury cadmium telluride channel (HgCdTe, 7 to 14 mm). A ground cover experiment, an experiment on nonsystemic corn plants, and an experiment on systemic-stressed corn plants were included. The average spectral radiance temperature of corn plant populations was found (1) to be statistically significantly different for four healthy corn plant populations, (2) to increase with increased blight severity, and (3) to be statistically significantly different for varying rates of nitrogen applications. J.M.S.

N78-29538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1 JAN. - 30 APR. 1978
1978 172 p
(NASA-TM-79740; NTISUB/D/276-004) Avail: NTIS HC A08/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 2 which has been processed and input to the data files during the referenced months. Data, such as cloud cover and image quality, are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N78-29539*# Columbia Univ., New York. Astrophysics Lab.
JOINT OBSERVATIONS OF 4U1223-62 BY THE SAS-3 SATELLITE AND COLUMBIA UNIVERSITY PROPORTIONAL COUNTER EXPERIMENT ON NASA ROCKET 26.054 UH Final Report, 1 Aug. 1977 - 31 Jul. 1978
R. Novick and R. S. Wolff Aug. 1978 10 p refs
(Grant NsG-5200)
(NASA-CR-157356; CAL-1405) Avail: NTIS HC A02/MF A01 CSCL 05B

The pulsating X-ray binary 4U1223-62 and Vela X-1 were observed by Aerobee rocket-borne proportional counters. Valid X-ray events were telemetered and analyzed for possible flaring, quasiperiodic, and periodic pulsations, and for other nonstatistical behavior in the source. Both fast Fourier transform and autocorrelation programs were used. For several hours four days before and after the rocket flight, the SAS-3 satellite scanned the galactic plane in order to identify X-ray sources in the vicinity of 4U1223-62 and their intensities, and to provide positional accuracy of 0.25 for sources with intensity greater than 10% of the target. Observations of the source near the main peak of its pulsating period as defined by SAS-3 are discussed. There is no evidence of a spectral feature although twice as many photons were received as than from Vela X-1. A.R.H.

N78-29540# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROJECT GEOLOGICAL MAP TO THE MILLIONTH SCALE
Athos R. DosSantos, L. C. Chiang, P. R. Meneses, P. Veneziani, U. P. DosSantos, C. E. DosAnjos, E. Crepani, F. S. DoNascimento, M. P. Barbosa, P. R. Martini et al Jul. 1977 13 p In PORTUGUESE; ENGLISH summary
(INPE-1074-NTE/100) Avail: NTIS HC A02/MF A01

Methodologies for the systematic use of remote sensing techniques for regional geological mapping are reported. A large amount of new geological information was obtained permitting a better understanding of structural, tectonic and stratigraphical problems. The results obtained are important for delineating areas of mineral deposits. F.O.S.

N78-29541# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTRODUCTION TO A MULTISPECTRAL DATA ANALYSIS SYSTEM [APRESENTACAO DE UMA SISTEMATICA PARA A ANALISE DE DADOS MULTIESPECTRAIS]
Vitor Celso CelsodeCarvalho Apr. 1978 40 p refs In PORTUGUESE
(INPE-1227-NTE/115) Avail: NTIS HC A03/MF A01

A system that automatically translates multispectral data obtained by remote sensing is described. Basic concepts were examined briefly, and examples of application in various areas of natural resources were reviewed. Transl. by B.B.

N78-29542# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SOLAR RADIATION AND ITS AGRICULTURAL UTILIZATION ON THE HILLSIDES OF NORTHEAST BRAZIL [RADIACAO SOLAR E SUA IMPORTANICA NO APROVEITAMENTO AGRICOLA DE ENCOSTAS NO NORDESTEDO BRASIL]
Dagmar Finizola deSa Mar. 1977 118 p refs In PORTUGUESE
(INPE-1005-TPT/049) Avail: NTIS HC A06/MF A01

An annual and twelve monthly charts of mean global radiation for the Northeast of Brazil were drawn, with the average data of the daily solar radiation incident upon a horizontal surface at ground level, from 24 stations of the meteorological network of the Northeast. The global radiation incident upon plane surface with inclinations of 5, 10, 15, 20, 30, 45, 60, 75, and 90 degs. for exposures N, NE, E, SE, S, SW, W, and NW in the meteorological stations was also calculated. A preliminary application of establishing the relative potential evapotranspiration for the humid hillsides of the Serra de Baturite-CE, set upon the semi-arid Caatinga, is also included. Author

N78-29543# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETERMINATION OF VARIOUS TOPOGRAPHIES USING PHOTOGRAPHIC TEXTURE ANALYSIS OF LANDSAT IMAGES [DETERMINACAO DE VARIACOES TOPOGRAFICAS ATRAVES DA ANALISE DE TEXTURA FOTOGRAFICA DE IMAGENS LANDSAT]
Evlyn Marcia Leao DeMoraesNovo and Armando Pacheco DosSantos Jul. 1977 31 p refs In PORTUGUESE; ENGLISH summary
(INPE-1077-NTE/103) Avail: NTIS HC A03/MF A01

The relationship between the texture of LANDSAT images and topographic variation was studied. Topographic data were collected from LANDSAT images and topographic maps. A roughness index was used to represent image texture. This index represents the tonal variation within a 0.5 cm x 0.5 cm grid. Declivity data were collected from topographic maps at different scales to correlate with the roughness index. The obtained results showed the possibility of characterizing topographic conditions by analyzing the texture of LANDSAT images. J.M.S.

N78-29544*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPECTRAL METHOD FOR DETERMINING THE PERCENTAGE OF LIVE HERBAGE MATERIAL IN CLIPPED SAMPLES
Compton J. Tucker Nov. 1977 24 p refs Submitted for publication
(NASA-TM-78019) Avail: NTIS HC A02/MF A01 CSCL 20F

A laboratory spectroradiometric method for the rapid determination of live/dead vegetation percentages from clipped grass samples has been developed and preliminarily tested. The

method utilizes the red and photographic infrared reflectance or radiance differences between green vegetation and that of dead vegetation. Mixtures of green and dead material were found to have reflectances or radiances proportional to the percentage of green material present. This method offers the possibility that rapid live/dead spectroradiometric determinations may replace the tedious hand-sorting now generally in use for many situations. Author

N78-29545# Army Engineer Topographic Labs., Fort Belvoir, Va.

NEAR REAL TIME APPLICATION OF DIGITAL TERRAIN DATA IN A MINICOMPUTER ENVIRONMENT

James R. Jancaitis and William R. Moore Apr. 1978 30 p
(AD-A054008; ETL-0142) Avail: NTIS HC A03/MF A01 CSCL 08/2

Two developments have combined to significantly impact the growing number of applications dependent upon digital terrain elevation data, mathematical terrain modeling, and minicomputer growth. Digital representation of terrain form has previously required vast amounts of mass storage with the relatively slow speed data access associated with large databases. A technique has been developed for compact digital storage of elevation data which also decreases the data access times significantly, a polynomial terrain model. Also, the minicomputer industry has been experiencing dramatic increases in the processing speeds and digital storage capabilities along with steadily declining costs. Preliminary results of a recently initiated study into the impact of these developments on utilization of digital terrain elevation data is presented. Author (GRA)

N78-29546# Los Alamos Scientific Lab., N. Mex.

TECHNIQUE FOR DYNAMIC RANGE REDUCTION FOR LANDSAT RATIO IMAGES

G. W. Wecksung and J. R. Breedlove, Jr. 1978 7 p refs Presented at Electron. in Resources Management Conf., Alamogordo, N.M., 12-14 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-78-347; Conf-780410-1) Avail: NTIS HC A02/MF A01

A scheme for dynamic range reduction, based on a mathematical model of the multispectral image, is presented. It can be implemented on stand-alone digital image processing systems as well as general purpose computers. This technique also has potential application in machine classification of geological data. Digital image processing examples are presented in which this new scheme is compared with other commonly used techniques for dynamic range reduction. ERA

N78-29547# Los Alamos Scientific Lab., N. Mex.

GEOTHERMAL RESERVOIR CATEGORIZATION AND STIMULATION STUDY

Harold L. Overton (CER, Inc.) and Robert J. Hanold Jul. 1977 62 p refs
(Contract W-7405-eng-36)
(LA-6889-MS) Avail: NTIS HC A04/MF A01

Analyses of the fraction of geothermal wells that are dry indicate that geothermal reservoirs can be fitted into four basic categories: (1) Quaternary to late Tertiary sediments; (2) Quaternary to late Tertiary extrusives; (3) Mesozoic or older metamorphic rocks; and (4) Precambrian or younger rocks. Failure of geothermal wells to flow economically is due mainly to low permeability formations in unfractured regions. It is the high stress/low permeability category that is most amenable to artificial stimulation by hydraulic fracturing, propellant fracturing, or chemical explosive fracturing. Category (1) geothermal fields are not recommended for artificial stimulation because these younger sediments almost always produce warm or hot water. Most geothermal fields fit into category (2) and in certain cases, possess some potential for stimulation. The Geysers is a category (3) field, and its highly stressed brittle rocks should make this site amenable to stimulation by explosive fracturing techniques. Roosevelt Springs, UT, well 9-1 is in category (4) and is a flow failure. It represents a prime candidate for stimulation by hydraulic fracturing. ERA

N78-29548# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

THE COVERAGE BEHAVIOR OF ERDSAT FOR SOME SELECTED REGIONS OF THE WORLD [UEBERDECKUNGS-VERHALTEN DES ERDSAT FUER EINIGE AUSGEWAEHLTE GEBIETE AUF DER ERDOBERFLAECHE]

E. F. Jochim Mar. 1978 72 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-494)
(DLR-IB-552-78/1) Avail: NTIS HC A04/MF A01

The coverage behavior of a proposed European remote sensing satellite was investigated for each of its onboard sensors for Europe, the Amazon Basin, Indonesia, and Brazil. The proposed satellite will carry a multispectral scanner and a microwave sensor. It is concluded that the satellite orbit can be optimal only for one sensor for one region on the earth. ESA

N78-29549# Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.

WATERSHED RESEARCH IN EASTERN NORTH AMERICA. VOLUME 1: A WORKSHOP TO COMPARE RESULTS

David L. Correll 1977 477 p refs Workshop held at Edgewater, Md., 28 Feb. - 3 Mar. 1977 2 Vol.
(Grants NSF ENV-74-24271-A03; NSF ENV-74-24271)
(PB-279919/5; NSF/RA-770254; LC-77-84406) Avail: NTIS HC A21/MF A01 CSCL 08H

Results of research directed toward better understanding of the quantitative and qualitative properties of drainage basins, complete characterization of their ecosystems, and application of those understandings towards solutions to problems of environmental quality are discussed. Overviews of watershed programs, chemical loading of the watershed, hydrology, nutrient discharge, and particulate discharge are among the topics discussed. GRA

N78-29550# Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.

WATERSHED RESEARCH IN EASTERN NORTH AMERICA. VOLUME 2: A WORKSHOP TO COMPARE RESULTS

1977 458 p refs Workshop held at Edgewater, Md., 28 Feb. - 3 Mar. 1977 2 Vol.
(Grants NSF ENV-74-24271; NSF ENV-76-22045)
(PB-279920/3; NSF/RA-770255; LC-77-84406) Avail: NTIS HC A20/MF A01 CSCL 08H

Particulate discharge; micoorganism discharge; toxic materials discharge; and watershed modeling are discussed. GRA

N78-29551# National Technical Information Service, Springfield, Va.

OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Apr. 1978

Audrey S. Hundemann May 1978 273 p Supersedes NTIS/PS-77/0385; NTIS/PS-76/0319; NTIS/PS-75/362; COM-74-10969
(NTIS/PS-78/0423/0; NTIS/PS-77/0385; NTIS/PS-76/0319; NTIS/PS-75/362; COM-74-10969) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

This bibliography contains 118 abstracts. Government-funded research on exploration, mining, retorting, chemistry, environmental impacts, and policies relating to oil shale research is covered. Abstracts discuss such things as oil shale air and water pollution control, production of synthetic fuels, use of spent oil shale in road construction, identification of research and development priorities, and in situ recovery of shale oil. GRA

N78-29552# National Technical Information Service, Springfield, Va.

OIL SHALE MINING, PROCESSING, USES, AND ENVIRONMENTAL IMPACTS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Apr. 1978

Audrey S. Hundemann May 1978 281 p Supersedes NTIS/PS-77/0387; NTIS/PS-76/0320
(NTIS/PS-78/0424/8; NTIS/PS-77/0387; NTIS/PS-76/0320) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

This bibliography contains 272 abstracts. Worldwide research on exploration, mining, retorting, chemistry, thermal studies, environmental impacts, and policies relating to oil shale research

is discussed. The production of synthetic fuels from shale oil and the economics of oil shale operations are included. GRA

N78-29553# Kentucky Univ., Lexington.
ESTIMATING ENVIRONMENTAL DAMAGES FROM SURFACE MINING OF COAL IN APPALACHIA: A CASE STUDY Final Report
Alan Randall, Orlen Grunewald, Angelos Pagoulatos, Richard Ausness, and Sue Johnson Jan. 1978 143 p refs
(Contract EPA-68-01-3586)
(PB-279150/7; EPA-600/2-78-003) Avail: NTIS HC A07/MF A01 CSCL 08I

The value of environmental damage from surface mining for coal was estimated under four alternative regulatory regimes: (1) the existing regulations; (2) a 'no regulations' regime; (3) a regulatory regime similar to that which would be established by a Federal surface mining and reclamation bill; and (4) an alternative regulatory framework generated by the research team, which relies more heavily on economic incentives for damage prevention and reclamation. Aesthetic damage, deterioration of water quality for domestic, commercial and industrial uses, damages from increased floodings, damage to land and buildings, and damage to fish, wildlife and recreation related activities are determined. GRA

N78-29554# Colorado State Univ., Fort Collins.
DEVELOPMENT OF A SUBSURFACE HYDROLOGIC MODEL AND USE FOR INTEGRATED MANAGEMENT OF SURFACE AND SUBSURFACE WATER RESOURCES Final Report
H. J. Morel-Seytoux Dec. 1977 34 p refs
(Contract DI-14-34-0001-6064)
(PB-279629/0; W78-05934; FR-82; OWRT-B-144-Colo(6)) Avail: NTIS HC A03/MF A01 CSCL 13B

Concepts useful in studies of conjunctive management of surface and ground waters were introduced. In order to model both accurately and cost-effectively the effect of initial aquifer drawdowns on the future state of the system, artificial pumping rates for one period prior to the initial time were examined. With this approach it is possible to simulate the effect of initial conditions in the same way pumping effects are predicted. In addition for long term simulation the concept of sequential reinitialization was studied. In this manner daily simulation over many years can be carried with pumping and relaxation discrete kernels calculated for only a few periods. GRA

N78-29555# California Univ., Davis. Water Resources Center.
CALIFORNIA WATER RESOURCES CENTER Annual Report, 1 Jul. 1976 - 30 Sep. 1977
Dec. 1977 101 p
(PB-279614/2; W78-06040) Avail: NTIS HC A06/MF A01 CSCL 13B

The State of California and Federally funded research activities in the area of fresh water resources are documented. GRA

N78-29556# General Accounting Office, Washington, D. C. Community and Economic Development Div.
MUNICIPAL AND INDUSTRIAL WATER CONSERVATION-THE FEDERAL GOVERNMENT COULD DO MORE
3 Apr. 1978 77 p
(PB-279487/3; CED-78-66) Avail: NTIS HC A05/MF A01 CSCL 13B

An overview of opportunities for conserving municipal and industrial water supplies is provided. It discusses: conservation techniques, including domestic water-saving devices, metered usage, pricing structure, leakage control, water pressure control, education campaigns, industrial water conservation, the need for further analysis and dissemination of information on these devices, and the experiences of various utilities with one or more conservation measures. GRA

N78-29557# Texas Univ. at Austin. Center for Research in Water Resources.
METHODOLOGY FOR ANALYZING EFFECTS OF URBANIZATION ON WATER RESOURCE SYSTEMS Final Report
Larry W. Mays and Yeou-Koung Tung Jan. 1978 170 p refs
(Contract DI-14-34-0001-7092)
(PB-279663/9; CRWR-156; W78-05938; QWRT-A-043-TEX(1)) Avail: NTIS HC A08/MF A01 CSCL 08/4

A technique called state variable modeling is applied to analyze two major phases of the urban water resources system. The first phase was based upon a lumped mathematical model to describe unsteady, nonuniform sewer flow in terms of a set of first order ordinary differential equations. The model is compared with other routing techniques through the use of an example sewer network. For the second phase a nonlinear hydrologic system model was formulated in the state variable form. Hydrograph analysis in conjunction with optimization search technique was performed on 37 rain fall storm events in order to examine how the model parameters vary with levels of urbanization. GRA

N78-29558# Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
THE USE OF SATELLITE IMAGERY FOR LAKE CLASSIFICATION IN WISCONSIN
K. W. Holmquist and F. L. Scarpace 1977 41 p ref
(Contract DI-14-34-0001-6052; DI-14-34-0001-5050; OWRT Proj. A-062-WIS(1))
(PB-279628/2; WIS-WRC-77-08; W78-05935) Avail: NTIS HC A03/MF A01 CSCL 08H

The trophic status of inland lakes in the State of Wisconsin was assessed from LANDSAT data. The feasibility of using both the photographic representation of the LANDSAT imagery as well as the digital representation of the LANDSAT imagery to classify lakes was investigated. It was determined that LANDSAT imagery can be used to predict lake water parameters or trophic classification. Time series data analyses indicated the necessity of a periodic rather than a one-time data extraction process. GRA

N78-29559# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
PROCEEDINGS: 3RD KENTUCKY COAL REFUSE DISPOSAL AND UTILIZATION SEMINAR
Jerry G. Rose Dec. 1977 119 p Conf. held at Lexington, Kentucky, 11-12 May 1977 Sponsored in part by Southeast Community Coll., Cumberland, Kentucky
(PB-279321/4; IMMR32-M4-77) Avail: NTIS HC A06/MF A01 CSCL 08I

State-of-the-art of coal cleaning and preparation is reviewed. Preparation plant design and construction, refuse treatment and disposal, and waste utilization are among the topics discussed. Economic aspects are included. GRA

N78-29560# National Weather Service, Silver Spring, Md. Office of Hydrology.
DERIVATION OF INITIAL SOIL MOISTURE ACCOUNTING PARAMETERS FROM SOIL PROPERTIES FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM
Bobby L. Armstrong (Tulsa River Forecast Center, Okla.) Mar. 1978 56 p refs
(PB-210710/5; NOAA-TM-NWS-HYDRO-37; NOAA-78040601) Avail: NTIS HC A04/MF A01 CSCL 08H

Each parameter used in the conceptual runoff model is investigated, and a computational procedure relating to soil properties is developed. Parameters are derived (for Council Creek near Stillwater, Okla.) and used in a computer verification program. A practical and useful solution for obtaining soil moisture accounting parameters from soil properties is demonstrated. The effectiveness of this procedure can be increased by using it in conjunction with the parameters derived from basin hydrographs. GRA

N78-29561# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
CROP FORECASTING BY SATELLITE: PROGRESS AND PROBLEMS Report to the Congress
31 Mar. 1978 37 p refs
(PB-279437/8; PSAD-78-52) Avail: NTIS HC A03/MF A01 CSCL 02B

The progress and problems in research to improve the Department of Agriculture's foreign crop forecasting system are discussed. The experiment uses satellite imagery from LANDSAT

to measure how many acres of wheat are growing, and also uses weather data to estimate the yield. GRA

N78-29562# Fish and Wildlife Service, Ft. Collins, Colo.
COOPERATIVE INSTREAM FLOW SERVICE GROUP: THE FIRST YEAR
David C. Flaherty Aug. 1977 12 p Sponsored by EPA, Wash., D. C.
(PB-279496/4; FWS/OBS-77/36) Avail: NTIS HC A02/MF A01 CSCL 08H

The activities and accomplishments of the Cooperative Instream Flow Service Group are reported. CIFSG's areas of research include: (1) development of improved methods of assessing and predicting instream flow requirements for fish, wildlife, other aquatic organisms, recreation and aesthetics; (2) development and improvement of guidelines for implementing instream flow recommendations; (3) establishment of an effective communications network for disseminating instream flow information. GRA

N78-29563# Iowa Univ., Iowa City. Inst. of Hydraulic Research.
THERMAL REGIMES OF THE MISSISSIPPI AND MISSOURI RIVERS DOWNSTREAM FROM THE SOUTHERN IOWA BORDER
A. R. Giaquinta and Titus T. C. Keng Jan. 1978 202 p refs Sponsored in part by Office of Water Res. and Technol.
(PB-279470/9; IIHR-211) Avail: NTIS HC A10/MF A01 CSCL 08H

The steady state version of the Iowa Thermal Regime Model (ITRM), a numerical model for the calculation of streamwise temperature distributions in rivers, was used to determine the existing and future thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border. The basic equations governing the conservation of thermal energy in a free surface flow were reviewed and the numerical model is presented. The empirical equations used to compute various heat transfer quantities are listed. The natural thermal regimes and the modified thermal regimes resulting from the imposition of external heat loads from power plants and other sources were calculated, and results are shown in the form of temperature distributions along the rivers for each case studied. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-29564 State Univ. of New York at Buffalo.
HYDRODESULFURIZATION AND LIQUEFACTION OF A BITUMINOUS COAL IN A BATCH AUTOCLAVE WITH PARTICULATE AND MONOLITH CATALYSTS Ph.D. Thesis
James Scinta 1978 190 p
Avail: Univ. Microfilms Order No. 78-10662

The experiments were divided into two studies: (1) a 2 to the 3d power factorial design to investigate the principle effects and interactions of catalyst pore diameter (100 A and 200 A), catalyst presulfiding (presulfided or not presulfided), and autoclave stirring rate (250 rpm and 500 rpm); and (2) a series of duplicate experiments to study the effects of three novel cobaltmolybdate monolith catalysts. Dissert. Abstr.

N78-29565 Stanford Univ., Calif.
PROPERTIES OF SPRAY PYROLYSIS CdS FILM AND ITS APPLICATION TO THIN FILM SOLAR CELL Ph.D. Thesis
Yueh Yale Ma 1978 149 p
Avail: Univ. Microfilms Order No. 7808811

A detailed investigation was made of the properties of cadmium sulfide films deposited on amorphous glass substrates by the technique of spray pyrolysis. The variation of the electrical transport properties of these films, as a function of substrate temperature was correlated with variations in orientation, cubic/hexagonal phase ratio, and morphology. Additional effects of cooling rate, spray rate, heat treatment in hydrogen, and variations in substrate were also considered. Heterojunction solar cells of n-cadmium sulfide/p-cadmium telluride were prepared by deposition of CdS films by spray pyrolysis on single crystal cadmium telluride to produce solar efficiencies greater than 6% without optimization or correction for reflection loss. Cells prepared by this method therefore compared favorably with cells prepared by vacuum evaporation of cadmium sulfide. Dissert. Abstr.

N78-29566*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE AND STABILITY ANALYSIS OF A PHOTOVOLTAIC POWER SYSTEM Final Report
Walter C. Merrill, Ronald J. Blaha, and Roy L. Pickrell Aug. 1978 43 p refs
(Contract E(49-26)-1022)
(NASA-TM-78880; E-9609; DOE/NASA/1022-78/30) Avail: NTIS HC A03/MF A01 CSCL 10A

The performance and stability characteristics of a 10 kVA photovoltaic power system are studied using linear Bode analysis and a nonlinear analog simulation. Power conversion efficiencies, system stability, and system transient performance results are given for system operation at various levels of solar insolation. Additionally, system operation and the modeling of system components for the purpose of computer simulation are described. F.O.S.

N78-29567*# General Electric Co., Wilmington, Mass. Aircraft Equipment Div.
SOLID POLYMER ELECTROLYTE (SPE) FUEL CELL TECHNOLOGY PROGRAM Final Report
15 Mar. 1978 88 p
(Contract NAS9-15286)
(NASA-CR-151750; TPR-047) Avail: NTIS HC A05/MF A01 CSCL 22A

Many previously demonstrated improved fuel cell features were consolidated to (1) obtain a better understanding of the observed characteristics of the operating laboratory-sized cells; (2) evaluate appropriate improved fuel cell features in 0.7 sq ft cell hardware; and (3) study the resultant fuel cell capability and determine its impact on various potential fuel cell space missions. The observed performance characteristics of the fuel cell at high temperatures and high current densities were matched with a theoretical model based on the change in Gibbs free energy voltage with respect to temperature and internal resistance change with current density. Excellent agreement between the observed and model performance was obtained. The observed performance decay with operational time on cells with very low noble metal loadings (0.05 mg/sq cm) were shown to be related to loss in surface area. Cells with the baseline amount of noble catalyst electrode loading demonstrated over 40,000 hours of stable performance. A.R.H.

N78-29568*# Florida Univ., Gainesville. Dept. of Electrical Engineering.
STUDY OF ELECTRONIC PROPERTIES IN PROTON- AND ELECTRON-IRRADIATED GaAlAs AND GaAs SOLAR CELL MATERIALS Final Report, 1 Sep. 1977 - 31 Aug. 1978
Sheng S. Li 31 Aug. 1978 69 p refs
(Grant NsG-1425)
(NASA-CR-157475) Avail: NTIS HC A04/MF A01 CSCL 10A

Diagnostical measurement techniques such as dark I-V, C-V, the thermally insulated capacitance, and the deep level transient spectroscopy methods were employed to study defect properties in the proton-irradiated n-GaAs materials. Defect energy levels, thermal emission rates, and capture cross sections of electrons as well as trap densities were deduced from these measurements and the results are presented. Correlations between the measured defect parameters and the dark I-V characteristics of the n-GaAs Schottky barrier diodes are also discussed. Defect energy

levels (i.e., electron traps) determined are also compared with published data in order to identify their physical origins. J.M.S.

N78-29569# Bergbau-Forschung G.m.b.H., Essen (West Germany).
EVALUATION OF A DATA BASE FOR A 100 MW COAL BURNING POWER USING PRESSURIZED FLUIDIZED BED COMBUSTION Final Report
Hans-Dieter Schilling, Heinz Schreckenberg, and Heinrich Muenzer Dec. 1977 139 p refs In GERMAN; ENGLISH summary
(BMFT-FB-T-77-48) Avail: NTIS HC A07/MF A01; ZLDI Munich 29,20 DM

Experiments aimed at an abatement of pollutant emissions and at an optimization of the controlling parameters. Results revealed unequivocally that emission of pollutants from fluidized bed combustors can be kept well within the limits set by TA-Luft regulations at comparatively low cost. Design of an open cycle, gas turbine plant led to a plant size promising full scale-up of the results at minimum cost. Author

N78-29570*# CALMAC Mfg. Co., Englewood, N. J.
DESIGN AND INSTALLATION PACKAGE FOR A SOLAR POWERED PUMP
Jul. 1978 34 p refs Prepared for DOE
(Contract NAS8-32253)
(NASA-CR-150740) Avail: NTIS HC A03/MF A01 CSCL 10A

The design and installation procedures of a solar powered pump developed by Calmac Manufacturing Company are presented. Subsystem installation, operation and maintenance requirements, subsystem performance specifications, and detailed design drawings are included. J.M.S.

N78-29571*# Solar Control Corp., Boulder, Colo.
INSTALLATION PACKAGE FOR 77-180 SOLARSTAT AND 77-1 CONTROLLER
Jul. 1978 25 p Prepared for DOE
(Contract NAS8-32258)
(NASA-CR-150743) Avail: NTIS HC A02/MF A01 CSCL 10A

The installation, operation, and maintenance of the SOLARSTAT and the basic modular controller are described. Specifications are included. J.M.S.

N78-29572*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC ASSESSMENT OF OWENS-ILLINOIS SUNPAK COLLECTOR PROBLEMS Final Report
Bernhard L. Wiesenmaier Jul. 1978 62 p refs Prepared for DOE
(NASA-TM-78179) Avail: NTIS HC A04/MF A01 CSCL 10A

An in-depth assessment is presented of problems encountered with the Owens-Illinois SUNPAK collector installed in several ERDA solar system demonstration sites. Analysis and independent tests of the collector in the MSFC Solar Simulator where the system failure conditions were duplicated are included. The basic design of the SUNPAK collector was shown to be sound; however, material limitations dictate that near-term applications constraints be recognized by system designers. MSFC recommendations were presented to ERDA in March 1977. Subsequent retrofit activity by Owens-Illinois appears to have been effective in demonstrating the integrity of the SUNPAK collector. F.O.S.

N78-29573*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT, TESTING, AND CERTIFICATION OF LIFE SCIENCES ENGINEERING SOLAR COLLECTOR Final Report
John M. Caudle Jul. 1978 103 p refs Prepared for DOE
(NASA-TM-78182) Avail: NTIS HC A06/MF A01 CSCL 10A

Results are presented for the development of an air flat plate collector for use with solar heating, combined heating and cooling, and hot water systems. The contract was for final development, testing, and certification of the collector, and for delivery of a 320 square feet collector panel. L.S.

N78-29574*# Ionics, Inc., Watertown, Mass. Research Div.
ANION PERMSELECTIVE MEMBRANE
S. S. Alexander and R. B. Hodgdon Jan. 1978 77 p
(Contracts NAS3-20108; E(49-28)-1002)
(NASA-CR-135316; CONS/0108-1) Avail: NTIS HC A05/MF A01 CSCL 10A

Experimental anion permselective membranes were improved and characterized for use as separators in a chemical redox, power storage cell being developed at the NASA Lewis Research Center. The goal of minimal Fe(+3) ion transfer was achieved for each candidate membrane system. Minimal membrane resistivity was demonstrated by reduction of film thickness using synthetic backing materials but usefulness of thin membranes was limited by the scarcity of compatible fabrics. The most durable and useful backing fabrics were modacrylics. One membrane, a copolymer of 4 vinylpyridine and vinyl benzylchloride was outstanding in overall electrochemical and physical properties. Long term (1000 hrs) membrane chemical and thermal durability in redox environment was shown by three candidate polymers and two membranes. The remainder had good durability at ambient temperature. Manufacturing capability was demonstrated for large scale production of membrane sheets 5.5 sq ft in area for two candidate systems. Author

N78-29575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE WIND TURBINE GENERATORS
Ronald L. Thomas and Richard M. Donovon Mar. 1978 37 p refs Presented at 5th Energy Technol. Conf. and Exposition, Washington, D. C., 27 Feb. - 1 Mar. 1978
(Contract E(49-26)-1059)
(NASA-TM-73767; DOE/NASA/1059-78/1; E-9553) Avail: NTIS HC A03/MF A01 CSCL 10B

The development associated with large wind turbine systems is briefly described. The scope of this activity includes the development of several large wind turbines ranging in size from 100 kW to several megawatt levels. A description of the wind turbine systems, their programmatic status and a summary of their potential costs is included. L.S.

N78-29576*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL ENERGY STORAGE FOR INDUSTRIAL WASTE HEAT RECOVERY
H. W. Hoffman (ORNL), R. J. Kedl (ORNL), and R. A. Duscha Aug. 1978 10 p Presented at 13th Intersociety Energy Conversion Engineering Conf., San Diego, Calif., 20-25 Aug. 1978
(Contracts EC-77-A-31-1034; W-7405-eng-26)
(NASA-TM-78953; DOE/NASA/1034-78/2; E-9702) Avail: NTIS HC A02/MF A01 CSCL 10C

The potential is examined for waste heat recovery and reuse through thermal energy storage in five specific industrial categories: (1) primary aluminum, (2) cement, (3) food processing, (4) paper and pulp, and (5) iron and steel. Preliminary results from Phase 1 feasibility studies suggest energy savings through fossil fuel displacement approaching 0.1 quad/yr in the 1985 period. Early implementation of recovery technologies with minimal development appears likely in the food processing and paper and pulp industries; development of the other three categories, though equally desirable, will probably require a greater investment in time and dollars. L.S.

N78-29577*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STORAGE SYSTEMS FOR SOLAR THERMAL POWER
James E. Calogeras and Larry H. Gordon Aug. 1978 9 p refs Presented at the 13th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 20-25 Aug. 1978
(Contract EC-77-A-31-1034)
(NASA-TM-78952; DOE/NASA/1034-78/1; E-9698) Avail: NTIS HC A02/MF A01 CSCL 10C

The development status is reviewed of some thermal energy storage technologies specifically oriented towards providing diurnal heat storage for solar central power systems and solar total energy systems. These technologies include sensible heat storage in caverns and latent heat storage using both active and passive heat exchange processes. In addition, selected thermal storage concepts which appear promising to a variety of advanced solar thermal system applications are discussed. L.S.

N78-29578*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

UTILIZATION OF SOLAR ENERGY IN DEVELOPING COUNTRIES: IDENTIFYING SOME POTENTIAL MARKETS

Gerald F. Hein and Toufiq A. Siddiqi (Environment and Policy Inst., Honolulu, Hawaii) Feb. 1978 13 p refs Presented at the Ann. Meeting of the Am. Assoc. for the Advan. of Sci., Washington, D.C., 12-17 Feb. 1978

(Contract E(49-28)-1022)

(NASA-TM-78964; DOE/NASA/1022-78/41) Avail: NTIS HC A02/MF A01 CSCL 10B

The potential use of solar electricity generated from photovoltaic cells is examined for nineteen developing nations. Energy and economic profiles are summarized for each country. A comparison is made between the use of autogeneration and photovoltaics in a rural area of Haiti. Author

N78-29579*# RHO Sigma, Inc., North Hollywood, Calif.

RS-600 PROGRAMMABLE CONTROLLER: SOLAR HEATING AND COOLING Progress Report, 30 Oct. 1976 - 1 Jul. 1977

Jul. 1978 28 p Prepared for DoE

(Contract NAS8-32256)

(NASA-CR-150744) Avail: NTIS HC A03/MF A01 CSCL 10A

Three identical microprocessor control subsystems were developed which can be used in heating, heating and cooling, and/or hot water systems for single family, multifamily, or commercial applications. The controller incorporates a low cost, highly reliable (all solid state) microprocessor which can be easily reprogrammed. J.A.M.

N78-29580*# Andover Control Corp., Mass.

INSTALLATION PACKAGE FOR INTEGRATED PROGRAMMABLE ELECTRONIC CONTROLLER AND HYDRONIC SUBSYSTEM - SOLAR HEATING AND COOLING

Aug. 1978 154 p Prepared for DoE

(Contract NAS8-32257)

(NASA-CR-150747) Avail: NTIS HC A08/MF A01 CSCL 10A

A description is given of the Installation, Operation, and Maintenance Manual and information on the power panel and programmable microprocessor, a hydronic solar pump system and a hydronic heating hot water pumping system. These systems are integrated into various configurations for usages in solar energy management, control and monitoring, lighting control, data logging and other solar related applications. L.S.

N78-29581# Ruhrchemie A.G., Oberhausen (West Germany).

STAGE AND DEVELOPMENT POSSIBILITIES OF THE FISCHER-TROPSCH-SYNTHESIS FOR THE PRODUCTION OF PRIMARY CHEMICALS AND FEEDSTOCKS

Dieter Frohning, Herbert Koelbel, Walter Rottig, Friedrich Schnur, and Hans Schulz Dec. 1977 103 p In GERMAN; ENGLISH summary

(BMFT-FB-T-77-43) Avail: NTIS HC A06/MF A01

The manufacture of chemical feedstocks from synthesis gas via the modified Fischer-Tropsch Synthesis is being studied. The aim is the development of catalysts which allow, with improved selectivity, a direct conversion of carbon monoxide with hydrogen to short chain olefins (C2 to C4) and/or naphtha for chemical use. The possible modifications of known process steps and catalysts are summarised in this study. The stage of development and the flexibility of the gasphase-fixed bed-entrained fluidised bed and the liquidphase-process are compared with one another with regard to present technical and economic demands. From this comparison, the synthesis of ethylene and propylene based on German brown coal, using conventional gasification and production technologies, is economic when the selectivity is approx. 50%. G.Y.

N78-29582# Gesellschaft fuer Vergasung und Verfluessigung von Steinkohle m.b.H., Essen (West Germany).

STUDY OF CAPITAL REQUIREMENTS, COST ESTIMATES AND ECONOMIC ANALYSIS OF A SRC-II (SOLVENT REFINED COAL) PLANT UNDER CONDITIONS RELATED TO THE FEDERAL REPUBLIC OF GERMANY

Karl Guenter Stroppel, Eckard Wolowski, Gerhart VonDiest (Geschaeftsbereich Anlagentechnik, Essen), and Hagen Roehrig (Geschaeftsbereich Anlagentechnik, Essen) Dec. 1977 106 p In GERMAN; ENGLISH summary

(BMFT-FB-T-77-64) Avail: NTIS HC A06/MF A01

The capital requirements and costs of a demonstration plant in the US for the production of liquid fuels based on the Solvent Refined Coal (SRC-2) process were estimated and the economics of a commercial SRC-2 plant were analyzed under conditions related to the Federal Republic of Germany. The process engineering design was adapted to German conditions and a complete cost calculation based on 1976 prices was elaborated. The results demonstrate that an economic operation of the SRC-2 plant cannot be realized at present. The specific product cost amounts to approximately 346,-DM/t to 400,-DM/t, depending on the assumptions as regards the project life. The current sale price, which equals 272,-DM/t, covers only 68% to 79% of the product cost. The capital requirements for a SRC-2 plant with a capacity of 6000 st/d of coal feed were estimated at 800 Mio. DM. J.M.S.

N78-29583*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE 200-KILOWATT WIND TURBINE PROJECT

Jan. 1978 17 p refs Prepared for DOE

(NASA-TM-79757) Avail: NTIS HC A02/MF A01 CSCL 10B

The three 200 kilowatt wind turbines described, compose the first of three separate systems. Proposed wind turbines of the two other systems, although similar in design, are larger in both physical size and rated power generation. The overall objective of the project is to obtain early operation and performance data while gaining initial experience in the operation of large, horizontal-axis wind turbines in typical utility environments. Several of the key issues addressed include the following: (1) impact of the variable power output (due to varying wind speeds) on the utility grid (2) compatibility with utility requirements (voltage and frequency control of generated power) (3) demonstration of unattended, fail-safe operation (4) reliability of the wind turbine system (5) required maintenance and (6) initial public reaction and acceptance. L.S.

N78-29584*# Rohr Industries, Inc., Chula Vista, Calif.

PRELIMINARY POWER TRAIN DESIGN FOR A STATE-OF-THE-ART ELECTRIC VEHICLE Final Report

James A. Ross and Gerald A. Wooldridge Apr. 1978 222 p refs

(Contracts NAS3-20592; EC-77-A-31-1044)

(NASA-CR-135340; RHR-78-035; DOE/NASA/0592-78/1) Avail: NTIS HC A10/MF A01 CSCL 10A

The state-of-the-art (SOTA) of electric vehicles built since 1965 was reviewed to establish a base for the preliminary design of a power train for a SOTA electric vehicle. The performance of existing electric vehicles were evaluated to establish preliminary specifications for a power train design using state-of-the-art technology and commercially available components. Power train components were evaluated and selected using a computer simulation of the SAE J227a Schedule D driving cycle. Predicted range was determined for a number of motor and controller combinations in conjunction with the mechanical elements of power trains and a battery pack of sixteen lead-acid batteries - 471.7 kg at 0.093 MJ/Kg (1040 lbs. at 11.7 Whr/lb). On the basis of maximum range and overall system efficiency using the Schedule D cycle, an induction motor and 3 phase inverter/controller was selected as the optimum combination when used with a two-speed transaxle and steel belted radial tires. The predicted Schedule D range is 90.4 km (56.2 mi). Four near term improvements to the SOTA were identified, evaluated, and predicted to increase range approximately 7%. F.O.S.

N78-29585*# North Carolina State Univ., Raleigh. Solid State Electronics Lab.

A THEORETICAL ANALYSIS OF THE CURRENT-VOLTAGE CHARACTERISTICS OF SOLAR CELLS Annual Report

R. C. Y. Fang and J. R. Hauser Sep. 1977 171 p refs

(Grant NGR-34-002-195)

(NASA-CR-157369) Avail: NTIS HC A08/MF A01 CSCL 10A

The correlation of theoretical and experimental data is discussed along with the development of a complete solar cell

analysis. The dark current-voltage characteristics, and the parameters for solar cells are analyzed. The series resistance, and impurity gradient effects on solar cells were studied, the effects of nonuniformities on solar cell performance were analyzed. F.O.S.

N78-29586# Rosenbaum (Bernard B.), Arlington, Va.
[CLOSED CYCLE BRAYTON TURBOMACHINERY RESEARCH] Final Report, period ending 30 Sep. 1977
Bernard B. Rosenbaum 30 Sep. 1977 13 p refs
(Contract N00014-76-C-0554)
(AD-A053024) Avail: NTIS HC A02/MF A01 CSCL 21/5

This report summarizes and appraises the technical and managerial aspects of the closed cycle Brayton turbomachinery research (CCBT) effort being sponsored by the ONR Power Program. GRA

N78-29587# Naval Surface Weapons Center, White Oak, Md.
LITHIUM-BORON ALLOY ANODES FOR MOLTEN SALT BATTERIES, 1 Progress Report
S. Dallek, D. W. Ernst, and B. F. Larrick 11 Jan. 1978 37 p refs
(AD-A053621; NSWC/WOL/TR-77-67-1) Avail: NTIS HC A03/MF A01 CSCL 10/3

The current work is concerned with the development of a procedure for the preparation of a lithium-boron alloy suitable for use as an anode in thermal batteries. Metallography, thermal analysis, and X-ray diffraction techniques are being developed as tools for studying this multiphase material. A chemical analysis is planned to identify the composition of the various phases. Once the phase diagram for the system has been determined, it will be possible to prepare material having optimum electrochemical properties for use as an anode material. Author (GRA)

N78-29588# Naval Civil Engineering Lab., Port Hueneme, Calif.
ANALYSIS OF CHAMBERLIN FLAT PLATE SOLAR COLLECTOR USING NATIONAL BUREAU OF STANDARDS TEST CRITERIA
E. R. Durlak Mar. 1978 20 p refs
(ZF57571001)
(AD-A054215; CEL-TN-1517) Avail: NTIS MF A02/MF A01 CSCL 10/2

Test results are presented for a flat plate, single glazed solar collector tested in accordance with the National Bureau of Standards test criteria. A description of the test apparatus and instrumentation is given. A graph of solar collector efficiency is presented. There was good agreement between test results and data taken from the manufacturer's brochure. Author (GRA)

N78-29589# Xerox Electro-Optical Systems, Pasadena, Calif.
THERMAL ENERGY STORAGE DEMONSTRATION UNIT FOR VUILLEUMIER CRYOGENIC COOLER Final Report, 15 Oct. 1976 - 31 Jul. 1977
Robert Richter Oct. 1977 138 p refs
(Contract F33615-75-C-2045)
(AD-A054466; AFAPL-TR-77-65; Rept-2340-F) Avail: NTIS HC A07/MF A01 CSCL 13/1

A thermal energy storage unit for a High Capacity (Hi-Cap) Vuilleumier Cryogenic Cooler was designed, built and performance tested. The unit was specified to have a sufficient thermal energy storage capacity for supplying one hot cylinder of the Hi-Cap Cryogenic cooler for 18 minutes with 650W of power at a maximum power loss of 5 percent through the insulation. The discharge of the unit was to take place at a nominal temperature of 1250 F + or - 25 F. A thermal energy storage (TES) unit with the hot cylinder of the Vuilleumier cooler was designed with a total thermal capacity of 737100 joules. The thermal energy is stored in the form of latent heat of fusion in the eutectic salt composed of lithium fluoride, magnesium fluoride and potassium fluoride. The unit was insulated with a multiple radiation shield super-insulation consisting of alternate layers of 0.020 inch thick Fiberfrax paper without binder and 0.001 inch Nickel foil. The insulation is maintained in a vacuum inside of an insulation container. The TES unit is instrumented for temperature control with two chromel alumel thermocouples. The single resistance temperature detector (RTD) failed during testing and is inoperative. All specified goals for the operation of the TES unit were achieved except for the maximum thermal loss through the insulation which exceeded the goal by 8W. This deviation could easily be corrected by interposing a condution insulation at the thermal ring of the unit. The report presents all pertinent design and fabrication information. GRA

N78-29590# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
WIND ENERGY STATISTICS FOR LARGE ARRAYS OF WIND TURBINES, GREAT LAKES AND PACIFIC COAST REGIONS Annual Progress Report, 1 May 1976 - 30 Apr. 1977
C. G. Justus and W. R. Hargraves May 1977 117 p refs
(Contract EY-76-S-06-2439; Proj. E-16-681)
(RLO/2439-77/2) Avail: NTIS HC A06/MF A01

Arrays of simulated 0.5 MW, 1.5 MW, and 2.0 MW wind turbines in the Great Lakes and Pacific Coast Regions are studied. The parameters analyzed are: basic wind statistics, time and spatial correlations, mean wind power output, wind power frequency, and run duration of wind speed and array power. New aspects include evaluation of diurnal as well as seasonal variations of wind and wind power, inclusion of density, wind shear, wind gusts and other factors in the model power output curve simulation, study of the possible relation between wind speed and degree days, and development and verification of a simplified array simulation model. ERA

N78-29591# Sandia Labs., Albuquerque, N. Mex.
SUMMARY: WORKSHOP ON THE DOE COMBUSTION DIAGNOSTICS FACILITY
Jan. 1978 32 p Workshop held in San Francisco, 15-16 Jul. 1977
(Contract EY-76-C-04-0789)
(SAND-77-8287; Conf-770756) Avail: NTIS HC A03/MF A01

The concept, scope of research, and laboratory and equipment specifications were reviewed by representatives of the combustion research community. This review is summarized. Following presentations by Sandia and other representatives concerning current plans for various aspects of the Combustion Diagnostics Facility, the workshop attendees were organized into panels to review: the scope of research; the plans for user access; and the laboratory design and equipment specifications. Each of these panels was chaired by a representative of the combustion research community and their panel recommendations form the elements of the discussion presented. ERA

N78-29592# Center for Energy Policy, Inc., Boston, Mass.
SOLAR ENERGY APPLICATIONS CENTERS: A STRATEGY TO FACILITATE THE COMMERCIALIZATION OF SOLAR ENERGY IN NEW ENGLAND
Jan. 1978 151 p refs
(Contract EG-77-C-01-4007)
(HCP/M4007-01) Avail: NTIS HC A08/MF A01

A plan is provided for the Energy Research and Development Administration (ERDA), and in particular the four regional solar energy centers (RSECs) to establish a workable program for increasing the commercial market penetration of available solar technology for space conditioning and water heating. It is recommended that these centers concentrate their commercializing efforts on the building industry. This can be done by establishing a network of small local solar energy applications centers (SEACs) within the four regions to provide on-going assistance and education to members of the industry and their consumers. The present state of the solar energy industry are discussed. The problems faced in the commercialization of solar energy technology, particularly by the building industry are discussed. The programs that these SEACS will need to undertake are described in detail. G.Y.

N78-29593*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE POWER SYSTEM (SPS) CONCEPT DEVELOPMENT AND EVALUATION PROGRAM PLAN, JULY 1977 - AUGUST 1980
Feb. 1978 63 p refs Prepared in cooperation with DoE
(NASA-TM-79400; DoE/ET-0034) Avail: NTIS HC A04/MF A01 CSCL 22B

An overview of the program to evaluate the solar satellite power system concept is presented. Environmental, health, and

safety factors are examined along with economic, international, and institutional issues. ERA

N78-29594# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
PROGRAM PRESTO: PREPARATION OF REFERENCE ENERGY SYSTEMS THROUGH TIME
E. Beardsworth and G. Goldstein Aug. 1977 19 p
(Contract EY-76-C-02-0016)
(BNL-50723) Avail: NTIS HC A02/MF A01

The PRESTO is an interactive computer program to provide a convenient framework for energy accounts to specify quantitatively the flows in the U.S. energy system over time, and to permit manipulation of their values while maintaining internal consistency. Then, once a scenario is defined, several of its attributes and implications are calculated (costs, total resource use, and environmental effects). It is based on the Reference Energy System methodology, a diagrammatic description of energy flows, but with the explicit incorporation of the time dimension. ERA

N78-29595# Monosolar, Inc., Santa Monica, Calif.
IMPROVED SEMICONDUCTORS FOR PHOTOVOLTAIC SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1977
30 Jul. 1977 8 p refs
(Contract EX-76-C-01-2457)
(DSE/2457-4; QR-4) Avail: NTIS HC A02/MF A01

An electroplating method for making thin films of both n- and p-type CDTe and operable photovoltaic junctions of the two together on a substrate of electrically conductive, light transparent SnO2:Sb on glass is described. For the complete junctions, measured efficiencies ranging between 0.3 and 0.6% were achieved with indications that higher efficiencies could be achieved upon elimination of a spurious or parasitic junction within the cell whose output appears to buck the desired one. ERA

N78-29596# Catalytica Associates, Inc., Palo Alto, Calif.
ASSESSMENT OF FUEL PROCESSING ALTERNATIVES FOR FUEL CELL POWER GENERATION Final Report
J. A. Cusumano and R. B. Levy Oct. 1977 157 p refs
(EPRI Proj. 919-1)
(EPRI-EM-570) Avail: NTIS HC A08/MF A01

The hydrogen fuel-cell power plant is expected to become a commercial reality in the near future. The fuel processor which converts hydrocarbon feedstocks to hydrogen is an integral part of this system. Fuel-cell power systems presently being developed are capable of utilizing methane through light naphthas for this purpose; however, a reasonable fuel-cell market will require the use of a number of fuels, ranging from synthesis gas to distillate oils. In this context, No. 2 fuel oil is of particular interest. The present study focuses on hydrogen production technologies for dispersed fuel-cell power stations, using a No. 2 fuel-oil feedstock. The primary objective is to provide a perspective for the feasibility of efficiently converting this feed to hydrogen in a fuel processor which is integrated with the dispersed power station. The approach involved a comprehensive review and analysis of existing, emerging, and conceptual hydrogen production technologies. Of the processes considered, high-temperature steam reforming (both fixed and fluidized catalytic beds) and autothermal reforming are the more promising fuel-processing alternatives. ERA

N78-29597# CER Geonuclear Corp., Las Vegas, Nev.
WESTERN GAS SANDS PROJECT Status Report
1 Sep. 1977 100 p
(NVO/0655-100) Avail: NTIS HC A05/MF A01

Resource assessment activities consist of those conducted by U.S.G.S. in Denver and the outcrop study of the eastern Uinta Basin. Some base maps are complete and field investigations in the principal areas of interest are being conducted. Laboratory R and D activities funded by ERDA have been directed toward new tools and instrumentation systems, rock mechanics experiments, mathematical modeling and data analysis. Many items are arbitrarily reported in this category and in the section devoted to the laboratories and Energy Research Centers even though they require considerable field experimentation. The positive results of system development and data analysis techniques in determining fracture orientation have been very encouraging. The Uinta BSIN in Utah and Piceance Basin in Colorado have had seven massive hydraulic fracture (MHF) experiments in the Upper Cretaceous tight gas formations. ERA

N78-29598# Illinois Univ., Urbana. Center for Advanced Computation.
ERDA NET ENERGY ANALYSIS PROGRAM Final Report
Clark W. Bullard 30 Sep. 1977 17 p refs
(Contract EY-76-S-02-2865)
(COO-2865-11) Avail: NTIS HC A02/MF A01

Work performed from March 1976 through September 1977 in support of the net energy analysis program is summarized. A handbook was prepared for use by persons performing net energy types of goods and services, and embodies several methodological advances. Quantitative estimates were made for the effects of certain deviations from this standard, including internalization of R and D expenditures, regulation, and capital investment. A method was developed for evaluating net energy impacts of energy conservation options, and for comparing them to supply development alternatives. ERA

N78-29599# Microeconomic Associates, Berkeley, Calif.
OVERVIEW OF THE ECONOMIC THEORY OF UNCERTAINTY AND ITS IMPLICATIONS FOR ENERGY SUPPLY
R. J. Gilbert, D. M. G. Newbery, and J. E. Stiglitz Jan. 1978 83 p refs
(EPRI-EA-586) Avail: NTIS HC A05/MF A01

An overview is given, of economic theory of uncertainty and much of the economics literature of the past 10 to 15 years on risk and uncertainty is summarized. The economic principles of risk bearing, which include such topics as the measurement of risk, the institutional structures by which risks are shared in the economy, activities that reduce risk, and market mechanisms that provide incentives for risk reduction. The effects of uncertainty on the price and quantity decisions of forms are examined. Also reviewed are the sources of risk, the characteristics of risk, the producer's attitudes toward risk, and the effects of market structure and regulation on decision making. ERA

N78-29600# Solar Energy Technology, Inc., Bedford, Mass.
IMAGE COLLAPSING CONCENTRATORS Quarterly Technical Progress Report, 30 Sep. - 31 Dec. 1977
C. J. Sletten 30 Jan. 1978 7 p
(Contract EG-77-G-04-4163)
(ALO-33; QTPR-1) Avail: NTIS HC A02/MF A01

Analytical studies of wide-angle two point (angle) corrected cylindrical Fresnel lenses based on two novel theoretical methods were successfully carried out. Engineering definition of a stepped lens focusing well over an approximately 50 deg elevation angle zone was achieved using flat prisms. Image Collapsing Concentrator investigations resulted in a definition of optimum focusing conditions on cylindrical lenses for different elevation angle sectors and these analytic results were checked using static temperature measurements and a computer ray tracing procedure. A new method for calculating subreflector shaping for aberration correction on a circular cylindrical dielectric lens was developed. ERA

N78-29601# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Geophysik.
GEOTHERMIC MODEL FOR THE RISE OF DEEPER GROUNDWATER ALONG FAULTS IN UNCONSOLIDATED ROCKS
Dietrich Werner and Klasu-Dieter Balke 1977 16 p refs
(NP-22877) Avail: NTIS HC A02/MF A01

A simple model was derived which may be used to explain measured temperature anomalies in areas of unconsolidated rock containing faults. It is assumed that deep groundwater rises along the path provided by the faulting. The calculations were performed using temperature data from the Niederrhein-Bucht. The model yields a quantitative relationship between the vertical flow of groundwater and the temperature anomalies observed. The primary results indicate that the quantity of water flow required to produce the observed temperature distribution is quite small. No hydrological contradictions are associated with the model. ERA

N78-29602# Futures Group, Gastonbury, Conn.
INCORPORATING UNCERTAINTY IN ENERGY SUPPLY MODELS Final Report

John G. Stover, Winslow Hayward, and Harold S. Becker Feb. 1978 249 p
(EPRI Proj. 1012-1)
(EPRI-EA-703-Vol-2) Avail: NTIS HC A11/MF A01

A methodology is presented for incorporating uncertainty in simulation models. Uncertainty is incorporated through the introduction of future events that have important impact on the system if they occur, and through the introduction of uncertainty ranges for important exogenous inputs. In Volume 1, cross-impact analysis and Monte Carlo techniques are used to combine this information with the basic simulation model to produce uncertainty ranges for model output. The technique, called probabilistic system dynamics (PSD), is applied to ELECTRIC3, a model of the U.S. electric utility system. Volume 2 contains the appendices--User's Manual for Probabilistic System Dynamics Version of ELECTRIC3; Probabilistic Modifications to ELECTRIC3; Documentation of Probabilistic System Dynamics Version of ELECTRIC3; Definitions of Model Variables Used in Probabilistic System Dynamics Version of ELECTRIC3; ans Sample Simulation Runs With Original ELECTRIC3. ERA

N78-29603# Sandia Labs., Albuquerque, N. Mex.
DIAGNOSTICS ASSESSMENT FOR ADVANCED POWER SYSTEMS Interim Report
D. R. Hardesty, R. J. Cattolica, W. L. Flower, M. C. Branch (Colorado Univ.), H. W. Coleman, L. A. Rahn, A. J. Mulac, R. A. Hill, and D. P. Aeschliman Feb. 1978 130 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8206; IR-2) Avail: NTIS HC A07/MF A01

Work accomplished during the second six month's effort in Sandia Laboratories Diagnostics Assessment Program for the Advanced Power Systems Branch of the Energy Technology Division, Department of Energy is summarized. A principal objective of this program is to perform a continuing review and technical assessment of state-of-the-art diagnostic techniques. The intended application of these techniques is the characterization of the flow at the combustor exit and turbine inlet in advanced open-cycle gas turbine systems which will be used for stationary power generation and which will be fired with coal, coal-derived liquid and gaseous fuels, or heavy residual fuels. A brief outline of the principal results and conclusions of the first Interim Report is included. ERA

N78-29604# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
DEVELOPMENT OF AN IRON-AIR BATTERY SYSTEM FOR ELECTRIC VEHICLES Progress Report, Jun. - Oct. 1977
E. S. Buzzelli Nov. 1977 20 p
(Contract EY-76-C-02-2949)
(TID-27914; PR-10) Avail: NTIS HC A02/MF A01

The development program on secondary iron-air cells continued to advance both electrodes, as well as establish state-of-the-art characteristics for 100 sq cm cells. Investigations on the air electrodes studied alternate electrode compositions fabricated by either the dry powder method or the wet pasting technique. Work on the iron electrode concluded some of the studies which were in progress, initiated some exploratory work dealing with metal additives to the electrode, at a reduced level of effort. A new 25 foot hydrogen belt furnace was installed and made operational for iron electrode fabrication and studies. Increased effort was put into the building and testing of iron-air cells. These tests are initially intended to demonstrate the cycle stability of both the electrodes to establish a base line for future comparisons in a variety of configurations, without immediate concern for an optimized design. Results to date showed cyclic stability of the capacity of the iron electrode in 100 sq cm cells, while other cells showed stable voltage characteristics of the air electrode. ERA

N78-29605# California Univ., Livermore. Lawrence Livermore Lab.
CURRENT STATUS OF COMPOSITE FLYWHEEL DEVELOPMENT
Richard H. Toland 17 Jan. 1978 23 p refs Presented at the 23d Natl. SAMPE Symp., Anaheim, Calif., 1-4 May 1978
(Contract W-7405-eng-48)
(UCRL-80604; Conf-780502-4) Avail: NTIS HC A02/MF A01

Recent developments in the applications of fiber composite materials to flywheel energy storage systems are reviewed. The impact of these materials on flywheel energy storage is discussed, in relation to transportation systems, specifically the performance requirements and the effect of system constraints on the ultimate effectiveness of the composite rotors. General flywheel design concepts are discussed, in light of several performance criteria and the inherent design and material limitations, including those effecting reliability and life. Specific composite rotors that were built and tested are discussed in terms of their demonstrated performance and are assessed for their potential. Recent government-sponsored research and development programs also are briefly reviewed and recommendations are made for future work. ERA

N78-29606# Sandia Labs., Albuquerque, N. Mex.
COMPOSITE-RIM FLYWHEEL DESIGN
E. D. Reedy, Jr. 1977 12 p refs Presented at the 23d Natl. SAMPE Symp., Anaheim, Calif., 2 May 1978
(Contract EY-76-C-04-0789)
(SAND-77-1061C; Conf-780502-5) Avail: NTIS HC A02/MF A01

The design of a flywheel which incorporates a circumferentially wound rim is described. The design required the selection of materials and configuration for rim and hub, and a means of attaching the rim of the hub. The method used to fabricate prototype flywheels of this design is discussed. ERA

N78-29607# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
DIAGNOSTIC TESTS DETERMINING THE THERMAL RESPONSE OF A HOUSE
Robert Sonderegger 1 Nov. 1977 18 p refs Presented at the ASHRAE Meeting, Atlanta, 29 Jan. - 2 Feb. 1978
(Contracts W-7405-eng-48; EC-77-S-02-4288)
(LBL-6856; Conf-780122-1) Avail: NTIS HC A02/MF A01

Two different approaches to the determination of the thermal response of buildings are possible: deterministic models and methods based on equivalent thermal parameters (ETP's) of a building. While the former are computer applications of heat transfer theory, the latter consist of data oriented techniques that infer the ETP's of a particular building by multiple correlation of indoor temperature and weather. The ETP method is convenient to provide a rank ordering of different houses by their thermal performance and to assess the overall effects of retrofits on a house. Like deterministic methods, the ETP method can also predict accurate free-floating indoor temperatures and heating loads as a function of weather. A convenient set of ETP's is established for a residential townhouse by means of a simple, single thermal mass model. ERA

N78-29608# Sandia Labs., Albuquerque, N. Mex. Aerothermodynamics Div.
SLAGGING MHD GENERATOR: A PARAMETRIC STUDY
John G. Taylor 1977 30 p refs Presented at the 17th Symp. on Eng. Aspects of MHD, Stanford, Calif., 27 Mar. 1978
(Contract EY-76-C-04-0789)
(SAND-77-1951) Avail: NTIS HC A03/MF A01

The design and performance of a direct coal fired MHD generator depends on the effect the liquid slag layer has on the fluid dynamic, heat transfer, and electrical characteristics of the generator. A simplified, self consistent analysis of the slagging MHD generator is presented. A detailed study of the interaction between the turbulent gasdynamic boundary layer and the condensing slag layer in the presence of electrodynamic forces was initiated. The vapor condensation for a laminar boundary layer flow over infinitely segmented Faraday connected electrodes in the entrance region of the generator was examined. Simply stated, a mixture of a condensible vapor (slag) and a noncondensible gas (seeded coal combustion products) flows through an MHD channel with wall temperatures below the condensation temperature of the vapor. The vapor condenses on the walls creating a liquid slag layer. ERA

N78-29609# California Univ., Livermore. Lawrence Livermore Lab.
CONDITIONING OF GEOTHERMAL BRINE EFFLUENTS FOR

INJECTION: USE OF COAGULANTS
R. Quong, F. Shoepflin (Bechtel Corp.), and N. D. Stout 1 Feb. 1978 18 p refs
(Contract W-7405-eng-48)
(UCID-17716) Avail: NTIS HC A02/MF A01

The use of various chemical coagulants and flocculants with spent geothermal brine for enhancing the removal of colloidal solids prior to injection was studied. Brine at 80 to 85 C was obtained from the injection line of the SDG and E/DOE Geothermal Loop Experimental Facility during a period of operation with Magmamax No. 1 Fluid. The solids consist primarily of an iron-rich amorphous silica and heavy metal sulfides, principal lead. Standard jar testing equipment was used to carry out the tests. ERA

N78-29610# Ohio Agricultural Research and Development Center, Wooster.
PROCEEDINGS OF A CONFERENCE ON SOLAR ENERGY FOR HEATING GREENHOUSES AND GREENHOUSE-RESIDENTIAL COMBINATIONS
T. E. Bond, L. C. Godbey, H. F. Zornig, and Ted H. Short, ed. Nov. 1977 350 p refs Proc. held at Cleveland, 20-23 Mar. 1977 Prepared in cooperation with DoE, Washington, D. C.
(CONF-770367) Avail: NTIS HC A15/MF A01

A research and development effort is reported that evaluates the feasibility of heating and cooling greenhouses and greenhouse-residential combinations by solar energy conversion. Energy research and energy policy abstracts represent the current state of the art. G.G.

N78-29611# Brookhaven National Lab., Upton, N. Y.
ALTERNATE MATERIALS OF CONSTRUCTION FOR GEOTHERMAL APPLICATIONS Progress Report, Jul. - Sep. 1977
L. E. Kukacka, J. Fontana, A. Zeldin, T. Sugama, W. Horn, N. Carciello, and J. Amaro 1977 30 p refs
(Contract EY-76-C-02-0016)
(BNL-50751; PR-14) Avail: NTIS HC A03/MF A01

A program to determine if non-metallic materials such as polymers, concrete polymer composites, and refractory cements can be utilized as materials of construction in geothermal processes is reported. Several high temperature polymer concrete systems were formulated, laboratory and field tests were performed in brine, flashing brine, and steam at temperatures up to 260 C. Laboratory data for exposure times more than two years are available. Results are also available from field exposures of up to 18 months in four geothermal environments. Good durability is indicated. Work at four of these sites is continuing. ERA

N78-29612# Battelle Pacific Northwest Labs., Richland, Wash.
BRINE CHEMISTRY AND COMBINED HEAT/MASS TRANSFER, VOLUME 1 Interim Report
D. W. Shannon Jan. 1978 248 p refs Sponsored by Electric Power Research Inst.
(Contract EY-76-C-06-1830)
(EPRI-ER-635-Vol-1) Avail: NTIS HC A11/MF A01

To develop analytical tools and a supporting data base to predict effects of scaling and corrosion on the performance of geothermal power plants, and the subsequent plant degradation in electric output and maintenance expense were studied. The program includes development of several computer programs, the geochemistry of scale formation, laboratory scaling kinetics studies, and analyses of the composition of several field scale samples. A computer code called EQUILIB was developed to calculate pH at temperature, gas pressures, concentrations of brine components, and the amount of potential mineral precipitates at temperatures of 25 to 300 C. The code is supported by an extensive data base of chemical equilibrium constants and a tabulation of brine compositions from literature sources. A laboratory scaling kinetics program indicates CaCO3 deposits almost instantaneously when brine flashing occurs, and data are presented on effects of temperature and salinity. Power plant computer models were developed for multistage flash or binary cycle type geothermal power. These codes permit the user to input mineral scale thicknesses at over 90 locations in the plant to calculate the effects of the scale on plant operating parameters and electric output. ERA

N78-29613# Grossman (R. E.) and Associates, Canoga Park, Calif.
REPRESENTATIVE INDUSTRIAL SOLAR ENERGY INSTALLATION, NORTHRIDGE HOSPITAL, NORTHRIDGE, CALIFORNIA
R. D. Grossman 29 Dec. 1977 78 p refs Prepared for Calif. Univ., Lawrence Livermore Lab.
(Contract W-7405-ENG-48)
(UCRL-13789) Avail: NTIS HC A05/MF A01

An engineering package for the design of a solar water heating system for the Northridge Hospital, a 300 plus bed hospital in Southern California, is presented. Flat plate collectors were utilized. Specifications and drawings of the system were given. Calculation sheets were included for the support system structural analysis heat exchanger performance check, pipe size and pressure load calculations, pump selection analysis, solar collector thermal performance, and collector attach system design requirements. Author (ERA)

N78-29614# Dynatrend, Inc., Arlington, Va.
NATIONAL FUEL CELL SEMINAR. PROGRAM AND ABSTRACTS
1977 124 p refs Seminar held at Boston, 21-23 Jun. 1977 Sponsored by DoE
(CONF-770664-Absts) Avail: NTIS HC A06/MF A01

Abstracts of 40 papers are presented. Topics include fuel cell systems, phosphoric acid fuel cells, molten carbonate fuel cells, solid fuel and solid electrolyte fuel cells, low temperature fuel cells, and fuel utilization. Author (ERA)

N78-29615# National Technical Information Service, Springfield, Va.
ENERGY CONSERVATION THROUGH BUILDING DESIGN. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1978
Audrey S. Hundemann May 1978 54 p
(NTIS/PS-78/0444/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 13M

This bibliography contains 48 abstracts. Federally-funded research on energy conservation through design of residential and commercial buildings is discussed. Topic areas cover the impact of building codes and standards on new construction and retrofitting of existing buildings, energy calculations for new building design, methods for estimating life cycle costs of alternative energy conservation techniques, inclusion of thermal insulation during building design, and window strategies. GRA

N78-29616# National Technical Information Service, Springfield, Va.
ENERGY CONSERVATION THROUGH BUILDING DESIGN. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1978
Audrey S. Hundemann May 1978 79 p
(NTIS/PS-78/0445/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 13M

This bibliography contains 72 abstracts. Energy conservation through design of both residential and nonresidential buildings is discussed. Topic areas cover solar radiation considerations in building planning and design, daylighting and window design, use of computer graphics for building energy analysis, design of ventilation and air flow systems in new buildings, and architectural design concepts. GRA

N78-29617# National Technical Information Service, Springfield, Va.
ENERGY CONSERVATION: BUILDINGS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS
Audrey S. Hundemann May 1978 168 p
(NTIS/PS-78/0502/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 13M

This bibliography contains 162 abstracts. Energy conservation in residential, commercial, and industrial buildings through use of efficient heating, air conditioning, and lighting systems is discussed. Topic areas cover the retrofitting of existing buildings, methods of detecting heat loss, efficient use of electric power, and the use of thermal energy storage and solar heat. Potential for conserving energy in buildings and guidelines and manuals for building owners are included. GRA

N78-29618# National Technical Information Service, Springfield, Va.
ENERGY CONSERVATION: BUILDINGS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Apr. 1978
Audrey S. Hundemann May 1978 161 p Supersedes NTIS/PS-77/0396; NTIS/PS-76/0403; NTIS/PS-75/214; COM-74-11138
(NTIS/PS-78/0503/9; NTIS/PS-77/0396) Avail: NTIS HC $28.00/MF $28.00 CSCL 13M
This bibliography contains 156 abstracts. For abstract, see N78-29617. GRA

N78-29619# Florida Univ., Gainesville.
CONCEPTS AND TECHNIQUES FOR EVALUATION OF ENERGY-RELATED WATER PROBLEMS Final Report
Flora C. Wang, Howard T. Odum, and Melvin E. Lehman Dec. 1977 70 p refs
(Contract DI-14-34-0001-6236)
(PB-279608/4; W78-05940; OWRT-C-7516(6236)(1)) Avail: NTIS HC A04/MF A01 CSCL 10A
The theory of energy analysis and the classical operational research techniques (linear programming) are applied towards a procedure that may serve the resource manager in decision making. The theory investigated involves the concepts of net energy, energy quality, and energy amplifier value. An attempt is made to estimate the energy value of water. The energy value of water is equal to the flow that it facilitates in a specific use. GRA

N78-29620# Washington State Univ., Pullman.
ENERGY CONSERVATION POLICY EVALUATION. STUDY MODULE 1A, VOLUME 2: TECHNICAL APPENDIX Final Report
Kenneth Bergstresser, Robert E. Berney, Lewis F. Carter, Lloyd B. Craine, and Riley C. Dunlap 1978 678 p Sponsored by Northwest Energy Policy Project, Portland, Oregon and Pacific Northwest Regional Commission, Vancouver, Washington
(PB-279664/7; NEPP-1-A-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 10A
Detailed technical analyses of energy conservation measures are presented. For each measure there is a description of how the measure works to reduce consumption; an assessment of potential savings, costs, and returns to adopters; probable 'normal' adoption rates under present policies; and potential adoption rates if some additional conservation policy options are implemented. Environmental residuals from energy end uses, and policy preferences of households and energy marketers are included. GRA

N78-29621# Charles River Associates, Inc., Cambridge, Mass.
INTEGRATING POLICY ANALYSIS Final Report
William R. Hughes and J. Hayden Boyd 1978 456 p Sponsored by Northwest Energy Policy Project, Portland, Oregon and Pacific Northwest Region Commission, Vancouver, Washington
(PB-279217/4; NEPP-8) Avail: NTIS HC A20/MF A01 CSCL 10A
The future energy supplies and demands in the Pacific Northwest are discussed along with the principal policy issues and alternatives which can shape the future of energy in the region. Analyses are provided of the various alternatives and the environmental impacts are quantified wherever possible. GRA

N78-29622# National Oceanic and Atmospheric Administration, Miami, Fla.
OCEAN THERMAL AND CURRENT VELOCITY DATA REQUIREMENTS FOR DESIGN OF AN OTEC DEMONSTRATION PLANT
Robert L. Molinari and John F. Festa Jan. 1978 33 p refs
(PB-280728/7; NOAA-TM-ERL-AOML-30; NOAA-78041216) Avail: NTIS HC A03/MF A01 CSCL 10B
The requirements for oceanographic data needed in the design of an OTEC demonstration plant and a methodology for obtaining ocean thermal and current velocity data are presented. In addition, some requirements for environmental impact data are given. GRA

N78-29623# National Academy of Sciences - National Research Council, Washington, D. C.
COAL AS AN ENERGY RESOURCE, CONFLICT AND CONSENSUS
Nov. 1977 332 p
(PB-279539/1; ISBN-0-309-02728-4) Avail: NTIS MF A01; HC National Academy of Sciences, 2101 Constitution Ave., Washington, D. C. 20418, HC $11.00 CSCL 10A
Based on proceedings of an Academy Forum, this report brings together both advocates and adversaries for increased coal production. It emphasizes the need to reconcile regional interests with the energy needs of the nation. Some topic areas covered are: The speed and locations at which coal should be developed; environmental impacts of development; coal technologies; and development in the Ohio River Valley, Kaiparowits, and the Northern Great Plains region. GRA

N78-29624# General Accounting Office, Washington, D. C. Energy and Minerals Div.
SOLAR DEMONSTRATIONS ON FEDERAL RESIDENCES: BETTER PLANNING AND MANAGEMENT CONTROL NEEDED
13 Apr. 1978 16 p
(PB-279485/7; EMD-78-53) Avail: NTIS HC A02/MF A01 CSCL 10A
The Department of Defense's management of a residential solar demonstration project is reviewed. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-29625 Oregon Graduate Center, Beaverton.
A FACTOR MODEL OF URBAN AEROSOL POLLUTION: A NEW METHOD OF SOURCE IDENTIFICATION Ph.D. Thesis
Ronald Claude Henry 1978 135 p
Avail: Univ. Microfilms Order No. 78-11524
Mass balance and correlation techniques are combined in a method of elemental analysis developed for identifying aerosol sources in an urban environment. Factor analysis is applied to the chemical elements mass balance equations for the aerosol. The mechanics of the model permits deduction of the elemental composition of a source from the knowledge of the amount of one element in the material emitted by the source. The presence of an important unknown source can be inferred and its elemental composition estimated. The validity of the model was tested by determining the concentration of Al, Si, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, and Pb in fifteen aerosol samples collected in Portland, Oregon and analyzed by X-ray fluorescence. Dissert. Abstr.

N78-29626 California Univ., Los Angeles.
THE AIR QUALITY AND OIL SPILL IMPLICATIONS OF ALASKAN OIL IMPORTATION INTO SOUTHERN CALIFORNIA Ph.D. Thesis
Stephen Wayne Kahane 1978 253 p
Avail: Univ. Microfilms Order No. 7811357
The proposed siting of the Standard Oil of Ohio (SOHIO) marine terminal and storage facilities in Long Beach, California was discussed. The SOHIO, the company with the largest share of Alaskan oil, proposes to transship approximately 500,000 barrels/day of Alaskan oil through the Port of Long Beach. The air quality impacts of the proposed SOHIO project were determined to be of particular concern because of their potential contribution to further deterioration of ambient air quality in an already polluted air basin. The air pollutant emissions associated with each of the various activities and operations of the marine terminal were identified, characterized, and discussed. Various operational scenarios were then developed to estimate emissions during both routine and emergency conditions. Dissert. Abstr.

N78-29627 Minnesota Univ., Minneapolis.
AERODYNAMIC PARTICLE SIZE MEASUREMENT BY

LASER-DOPPLER VELOCIMETRY Ph.D. Thesis
James Charles Wilson 1977 228 p
Avail: Univ. Microfilms Order No. 7809769

A method of measuring the aerodynamic diameter of aerosol particles was investigated. The method consists of accelerating particles in a converging nozzle and measuring their velocities near the exist of the nozzle with a laser Doppler velocimeter. This study involved theoretical and experimental studies of particle velocity near the exit of converging nozzles. The results were applied to the problem of sizing atmospheric aerosols in the diameter range from .5 to .10 microns. A theoretical analysis utilized boundary layer theory to predict the velocity of the gas in the nozzle, and then the equations of particle motion were integrated to give the theoretical particle velocities. The effects of nozzle geometry, flow rate, particle density and particle size were studied using the results of calculations made with dimensionless equations. Dissert. Abstr.

N78-29628# Greiner Environmental Sciences, Inc., Baltimore, Md.
MODEL ENVIRONMENTAL IMPACT STATEMENT NO. 1, BICENTENNIAL INTERNATIONAL AIRPORT, NORTHEAST, AMERICA Final Report
Nov. 1977 359 p
(Contract DOT-FA75W-3703)
(AD-A049171; FAA-AAP-78-2(1)) Avail: NTIS HC A16/MF A01 CSCL 05/5

The model describes a hypothetical air carrier airport at which the development of a new 10,000 foot parallel runway is proposed. A description is given of the project, the purpose, and the setting. It includes background information including the project history and community involvement. Fifteen impact categories are analyzed together waith a description of measures to be taken to minimize adverse effects. Emphasis in this case is given to noise impacts, direct socioeconomic effects and replacement of a public playground. Alternatives to the proposed runway are included in the environmental impact statement. Letters received from Federal agency review are included in the document as are responses to comments. Also included in the document is a sample decision paper and Federal Finding. L.S.

N78-29629# Greiner Environmental Sciences, Inc., Baltimore, Md.
MODEL ENVIRONMENTAL IMPACT STATEMENT NO. 2 FOR FREEDOM AIRPORT, SOUTHEAST, AMERICA Final Report
Nov. 1977 268 p
(Contract DOT-FA75W-3703)
(AD-A049300; FAA-AAP-78-2(2)) Avail: NTIS HC A12/MF A01 CSCL 05/5

This model covers site selection and development of a new general aviation airport to serve as a reliever for a major air carrier airport in a metropolitan area. The environmental impact statement includes sections on the project itself and its purpose, a summary of the site selection process and related actions, and an assessment of fifteen impact categories. The document also describes alternatives considered in the process and measures to be taken to minimize adverse effects. Office of Management and Budget Circular A-95 coordination results are included, aas are the results of Federal agency review of a draft. This hypothetical airport project involves development of a site which requires filling in a portion of a bay and displacement of a mobile home trailer park. Emphasis is placed on marine biology, recreational uses of the bay, and coastal zone considerations. Author

N78-29630# State Univ. of New York at Stony Brook. Marine Sciences Research Center.
AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND. APPENDIX B: WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL SEDIMENT PARAMETERS Final Report, 30 Oct. 1974 - 29 May 1975
Jan. 1978 332 p refs
(Contract DACW51-75-C-0016)
(AD-A053427; WES-TR-D-77-6-App-3) Avail: NTIS HC A15/MF A01 CSCL 13/2

Seven oceanographic cruises and three sediment coring cruises, which took place between October 30, 1974 and May 29, 1975, were conducted in western Long Island Sound to assess the baseline water column and sediment properties near the Eatons Neck disposal site. GRA

N78-29631# Naval Research Lab., Washington, D. C.
THE 1977 NRL AIR QUALITY DATA Final Report
A. Stamulis Apr. 1978 30 p refs
(AD-A054634; AD-E000160; NRL-MR-3764) Avail: NTIS HC A03/MF A01 CSCL 13/2

The air quality data included in this report are for the calendar year 1977. The present report is the third annual summary of air quality data obtained by the NRL air monitoring program initiated in 1975. The variables reported include ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), non-methane hydrocarbons (RHC), carbon monoxide (CO), wind speed, and wind direction. The data are obtained from monthly computer printouts of the air quality for different time-averages of interest. A yearly review of the main features of the air quality data is presented in this report. Author (GRA)

N78-29632# McElroy (Ralph) Co., Austin, Tex.
MEASUREMENT AT COOLING TOWER PLUMES. PART 1: MATHEMATICAL SIMULATION AND IMPORTANCE OF MEASUREMENTS
F. Gassmann, D. Haschke, and W. Solfrian Dec. 1977 104 p Transl. into ENGLISH of "Messungen an kuhlturmfahnen. Teil 1: Mathematische simulation und bedeutung von messungen" Rept. Juel-1250-pt-1. Kernforschungsanlage Juelich G.m.b.H., Apr. 1976 Sponsored by DOE
(ANL-Trans-1115-Pt-1) Avail: NTIS HC A06/MF A01

Model conceptions, assumptions and approaches are summarized which can lead to mathematical models for the simulation of dry or wet cooling tower plumes. By developing a one dimensional plume model (FOG), the most important problems are considered in detail. It is shown that for the calibration of the necessary parameters as well as for the development of models full scale measurements are of decisive importance. After a discussion of different possibilities of measurement the organization of a campaign of measurement is described. ERA

N78-29633# McElroy (Ralph) Co., Austin, Tex.
MEASUREMENTS AT COOLING TOWER PLUMES. PART 3: THREE-DIMENSIONAL MEASUREMENTS AT COOLING TOWER PLUMES
H. Fortak Jan. 1978 82 p refs Transl. into ENGLISH of "Messungen an kuhlturmfahnen. Teil 3: Dreidimensionale vermessung von kuhlturmfahnen", Rept. Juel-1250-Pt-3 Kernforschungsanlage Juelich G.m.b.H., Nov. 1975 Sponsored by DOE
(ANL-Trans-1117-Pt-3) Avail: NTIS HC A05/MF A01

An extended field experiment is described in which cooling tower plumes were studied by means of three dimensional in situ measurements. The goal was to obtain input data for numerical models of cooling tower plumes. Of special interest were data for testing or developing assumptions for subgrid parametrizations. Utilizing modern systems for high resolution aerology and small aircraft, four measuring campaigns were conducted. Because of the broad spectrum of weather situations it can be assumed that the results are representative with regard to the interrelationship between structure of cooling tower plume and large scale meteorological situation. A large number of flights with a powered glider crossing the plumes on orthogonal tracks was performed. All flights showed that the plume could be identified up to large downwind distances by discontinuous jumps of temperature and vapor pressure. ERA

N78-29634# California Univ., Livermore. Lawrence Livermore Lab. Environmental Sciences Div.
STUDIES OF AIR POLLUTION EFFECTS ON VEGETATION
Jan. 1978 43 p refs
(Contract W-7405-eng-48)
(UCID-17714) Avail: NTIS HC A03/MF A01

The report consists of three parts which summarize pollutant-vegetation effects research studies. These include: oxidant effects of primary productivity in ponderosa pine in the San Bernardino National Forest; air pollution effects on vegetation related to geothermal power development; and regional assessment of air pollution impact on vegetation by mathematical modeling. ERA

N78-29635# Brookhaven National Lab., Upton, N. Y.
TRADESCANTIA STAMEN HAIR: AN INTRODUCTION TO THE SYSTEM AND ITS USE AS A MONITOR ATMOSPHERIC POLLUTANTS
L. A. Schairer and J. Van'Thof 1978 38 p refs Presented at the Conf. on Higher Plant Systems as Monitors of Environ. Mutagens, Marineland, Fla., 16 Jan. 1978
(Contract EY-76-C-02-0016)
(BNL-23829; Conf-780121-1) Avail: NTIS HC A03/MF A01

The Tradescantia genetic system for the study of effects of ionizing radiation is applicable to chemical mutagen detection. Early radiobiological data demonstrated that the stamen hairs were sensitive to as little as 0.25 rad of X-rays and that cells showed a phenotypic change in pigmentation from blue to pink plateau after approximately 21 days of chronic, low-level irradiation. To monitor industrial sites for atmospheric mutagens a mobile laboratory was designed to support plant culture in the field. Environment-controlled growth chambers were installed in a trailer so that both ambient air fumigations and concurrent clean-air control exposures could be made. Atmospheric contaminants from petroleum and chemical processing plants generated a significant number of phenotypic pigment changes that were 17 to 31% above the control levels; contaminants from steel and copper smelters, automotive combustion products and photochemical compounds were negative. ERA

N78-29636# California Univ., Livermore. Lawrence Livermore Lab.
MAP3S: STUDYING THE TRANSPORT, TRANSFORMATION, AND FATE OF ATMOSPHERIC ENERGY-RELATED POLLUTANTS. ADDENDUM: PROJECTED LISTINGS FOR FY 1977
M. C. MacCracken Jan. 1978 118 p
(DOE/EV-0008/2) Avail: NTIS HC A06/MF A01

The goal of the Multistate Atmospheric Power Production Pollution Sutdy (MAP3S) program is to develop and demonstrate an improved, verified numerical capability to simulate the present and potential future changes in pollutant concentration, atmospheric behavior and precipitation chemistry as a result of pollutant releases to the atmosphere from large scale power production processes, primarily coal combustion. The research required to meet this goal is described in the MAP3S plan. This first annual addendum to the plan contains a listing of individual projects that are sponsored by MAP3S, both those on which progress can be reported based on work in FY-1976 and early FY-1977 and those being planned for FY-1977 and beyond. ERA

N78-29637# California Univ., Livermore.
SURVEY OF MODELS TO PREDICT THE EFFECT OF GEOTHERMAL POWER DEVELOPMENT ON DOMESTIC WATER SUPPLIES AND TO DESIGN POLLUTION MONITORING METHODS
K. D. Pimental 17 Aug. 1977 15 p refs Presented at the Intern. Federation for Inform. Processing Working Conf. on Modeling and Simulation of Land, Air and Water Resources Systems, Ghent, 30 Aug. 1977 - 2 Sep. 1977 Sponsored by DOE
(UCRL-79977; Conf-770854-1) Avail: NTIS HC A02/MF A01

The computer modeling and simulation of ground water solute transport, applicable to the design of pollution surveillance monitoring system is considered. Emphasis is placed on the effects of the development of geothermal power production on water quality of domestic artesian water wells in an area downstream from geothermal wells. J.M.S.

N78-29638# Radian Corp., Austin, Tex.
CONTROLLING SO2 EMISSIONS FROM COAL-FIRED STEAM-ELECTRIC GENERATORS; WATER POLLUTION IMPACT. VOLUME 1: EXECUTIVE SUMMARY Final Task Report, Apr. - Dec. 1977
R. L. Sugarek and T. G. Sipes Mar. 1978 34 p
(Contract EPA-68-02-2608)
(PB-279635/7; EPA-600/7-78-045a-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 07A

Results of a comprehensive program to review a New Source Performance Standards (NSPS) for SO2 emissions from coal-fired steam-electric generating plants is given. The results compare two alternative standard to the existing NSPS (1.2 lb SO2/million Btu of heat input): (1) 0.5 lb SO2/million Btu of heat input, allowing credit (as does the existing NSPS) for physical coal cleaning or use of low sulfur coal; and (2) 90% removal of SO2 from stack gases, regardless of original coal sulfur content. The comparisons are in terms of their effect on the quality and quantity of power plant wastewater effluents and on the amount of plant water consumption. GRA

N78-29639# Radian Corp., Austin, Tex.
CONTROLLING SO2 EMISSIONS FROM COAL-FIRED STEAM-ELECTRIC GENERATORS; WATER POLLUTION IMPACT. VOLUME 2: TECHNICAL DISCUSSION Final Task Report, Apr. - Dec. 1977
R. L. Sugarek and T. G. Sipes Mar. 1978 268 p refs
(Contract EPA-68-02-2608)
(PB-279636/5; EPA-600/7-78-045b-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 07A

Potential effects of SO2 control system effluents on the environment are evaluated, and alternative treatment processes are discussed. Volumes and quality of wastewater streams varied very little from one alternative New Source Performance Standard to another; all streams can be treated adequately using commercially available technologies. However, the alternative standards increase total water consumption 8-11%, depending on the FGD process used. Physi-coal cleaning plus lime/limestone scrubbing increases total water consumed 8-12%. GRA

N78-29640# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Appraisal of Societal Consequences of Transportation Noise Abatement.
ANALYTICAL STUDIES FOR THE US ENVIRONMENTAL PROTECTION AGENCY. VOLUME 4: ENVIRONMENTAL MONITORING
Feb. 1977 195 p refs
(Contract EPA-68-01-2430)
(PB-279534/2; ISBN-0-309-02639-3; LC-77-86463) Avail: NTIS HC A09/MF A01 CSCL 13B

Current monitoring programs are critically examined and areas where monitoring is needed are identified. Methods for improving the collection and use of scientific data for environmental management are recommended for professional in all areas of environment protection. GRA

N78-29641# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Appraisal of Societal Consequences of Transportation Noise Abatement.
ANALYTICAL STUDIES FOR THE US ENVIRONMENTAL PROTECTION AGENCY. VOLUME 8. NOISE ABATEMENT: POLICY ALTERNATIVES FOR TRANSPORTATION
Oct. 1977 203 p refs
(Contract EPA-68-01-2430)
(PB-279536/7; ISBN-0-309-02648-2; LC-77-87121) Avail: NTIS HC A10/MF A01 CSCL 13B

The policy and legal issues involved in noise abatement programs are examined. Topics cover distribution of noise in the U.S., trends in noise generation and methods of noise measurement and cost/benefit calculations are analyzed. GRA

N78-29642# National Technical Information Service, Springfield, Va.
MERCURY POLLUTION, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - 1976
Robena J. Brown May 1978 212 p
(NTIS/PS-78/0479/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography includes pollution control, environmental sampling and analysis, and air and water quality data. The toxicity and pollution effects are excluded. This updated bibliography contains 206 abstracts. GRA

N78-29643# National Technical Information Service, Springfield, Va.
MERCURY POLLUTION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Apr. 1978
Robena J. Brown May 1978 61 p Supersedes NTIS/PS-77/0428; NTIS/PS-76/0315; NTIS/PS-75/209
(NTIS/PS-78/0480/0; NTIS/PS-77/0428; NTIS/PS-76/0315;

NTIS/PS-75/209) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

This updated bibliography contains 55 abstracts. For abstract, see N78-29642.

N78-29644# Research Triangle Inst., Research Triangle Park, N. C.

US/USSR SYMPOSIUM ON PARTICULATE CONTROL (SECOND) Final Report, Jun. - Dec. 1977

Franklin A. Ayer Mar. 1978 271 p refs Symp. held at Research Triangle Park, N. C., 25-28 May 1977

(Contract EPA-68-02-2612)

(PB-279625/8; EPA-600/7-78-037) Avail: NTIS HC A12/MF A01 CSCL 13B

Papers were presented by Soviet specialists from research design institutes and industry, and by representatives of US government agencies and the private sector. Topics included: electrostatic precipitator (ESP) research and application; ESP gas flow modeling; ESP rapping and reentrainment; ESP reliability; ESP modeling; flue gas conditioning; high-temperature ESP application; use of fabric filters in the US cement industry; emission standards; state-of-the-art mist eliminators; mist eliminator testing; particle size distribution measurement in the micron and cron ranges; dust resistivity and back-corona formation in ESPs; and fly ash composition and its effect on resistivity. GRA

N78-29645# Oregon State Univ., Corvallis. Water Resources Research Inst.

ENVIRONMENT, TECHNOLOGY, AND FUTURE GENERATIONS

David A. Bella Jan. 1978 43 p refs

(Contract DI-14-31-0001-4209)

(PB-279605/0; WRRI-57; W78-05941; OWRT-C-5195(4209)(2)) Avail: NTIS HC A03/MF A01 CSCL 13B

When considering environmental management, it is useful to employ two terms which designate different levels of planning; i.e., strategies and tactics. Strategies involve comprehensive and broad outlooks. In contrast, environmental tactics involve more limited concerns which can be usually addressed in a disciplinary or multidisciplinary manner. The development of strategies necessitates interdisciplinary outlooks. A strategy is proposed which encourages an adjusting, learning and creative approach to the future rather than an approach which is ultimately based upon prediction and control. The approach is described through a set of five commitments which are intended, not as absolute rules, but as attitudes or considerations which should have increased influence upon decisions. A number of applications and examples are briefly discussed. GRA

N78-29646# Washington Univ., Seattle. College of Fisheries.

SEDIMENT AND WATER QUALITY: A REVIEW OF THE LITERATURE INCLUDING A SUGGESTED APPROACH FOR WATER QUALITY CRITERIA WITH SUMMARY OF WORKSHOP AND CONCLUSIONS AND RECOMMENDATIONS

Robert N. Iwamoto, Earnest O. Salo, Mary Ann Madej, R. Lynn McComas, and Robert L. Rulifson Feb. 1978 253 p refs Workshop held in Seattle, 10 Mar. 1977

(PB-279469/1; EPA-910/9-78-048) Avail: NTIS HC A12/MF A01 CSCL 13B

A review of the physical and biological aspects of sedimentation in the lotic environment was compiled. Over 300 annotated and 100 unannotated references are included. These were used as a resource for a workshop on needs for an alternative to turbidity measurements as a water quality criterion. Also included are a summary of the current state of investigations on stream sediments and turbidity measurements as a criterion. These include: composition of bed material, behavioral aspects of aquatic fauna, and clinical measurements of physiological functions as a measure of stress. The more significant conclusions are that sedimentation of the stream's substrate, particularly the gravel used for spawning, produces significant detrimental effects on the salmonid resources. GRA

N78-29647# Environmental Protection Agency, Washington, D. C. Office of Water Planning and Standards.

NATIONAL WATER QUALITY INVENTORY 1976 REPORT TO CONGRESS Annual Report

Jun. 1977 258 p

(PB-279462/6; EPA-440/9-76-024) Avail: NTIS HC A12/MF A01 CSCL 13B

State water quality reports to Congress are summarized. Major topics included are: (1) Contamination from toxic substances; (2) Assessments of the percentage of water currently meeting the goals of the Act and the percentage expected to meet those goals by 1983; and (3) An analysis of the effectiveness of current pollution control programs. Continued water quality problems are reported with excessive bacteria levels limiting recreational uses of water in many areas, high nutrient levels causing eutrophication problems, and low dissolved oxygen levels occurring in many smaller streams which receive large volumes of waste. However, improvements are noted in both bacterial and dissolved oxygen levels in many areas as municipal and industrial treatment plants are installed. GRA

N78-29648# Institute of Industry of Cement Building Materials, Opole (Poland).

TESTS OF FABRIC FILTRATION MATERIALS Final Report, Jun. 1973 - Dec. 1977

Jan R. Koscianowski, Lidia Koscianowska, and Maria Szablewicz Mar. 1978 218 p

(PB-279637/3; EPA-600/7-78-056) Avail: NTIS HC A10/MF A01 CSCL 13L

Laboratory and pilot scale testing of filter fabrics is described. Tests were made on flat specimens and on bags. Fifteen styles of fabrics (made from cotton, polyester, aramid, or glass) were tested, using cement, coal, or talc dusts. Collection efficiencies and pressure drop data are presented for inlet dust concentrations of 10-11g/cu m, filtration velocities of 60 and 80 cu m/sq m-hr, temperatures of 20-30 C, and relative humidities of 55-60%. Some conclusions reached were: (1) fabrics which performed well on bench scale apparatus also performed well on large scale apparatus; (2) free area calculations for characterizing fabrics are useful for staple fiber fabrics, but not for continuous filament fabrics; and (3) smooth fiber fabrics with low coefficients of friction may have poor collection efficiency at high filtration velocities. GRA

N78-29649# Rockwell International Corp., Creve Couer, Mo.

REGIONAL AIR POLLUTION STUDY: FUGITIVE DUST SURVEY AND INVENTORY Final Report

Robert W. Griscom, Edward O. Nelson, and Fred E. Littman Apr. 1978 218 p refs

(Contract EPA-68-02-2093)

(PB-279706/6; EPA-600/4-78-020) Avail: NTIS A10/MF A01 CSCL 13B

Several monitoring stations were equipped with high volume samplers and automatic dichotomous samplers to measure concentrations of atmospheric aerosols. In addition, two of the St. Louis City monitoring sites were used for special aerosol studies. Because of the strong potential influence of nearby ground level fugitive dust sources on aerosol measurements, site surveys were made within a radius of one mile of each site to assess fugitive dust sources, and an emissions inventory of these sources was calculated. GRA

N78-29650# Informatics, Inc., Rockville, Md.

FOREIGN NOISE RESEARCH IN NOISE EFFECTS. A SURVEY OF FOREIGN NOISE EFFECTS RESEARCH Final Report

Miriam Heilman Jan. 1978 92 p

(Contract EPA-68-01-4477)

(PB-279383/4; EPA-550/9-78-101) Avail: NTIS HC A05/MF A01 CSCL 06F

Results of a survey on foreign noise effects research from 1975-1977 are presented. The survey was conducted for the second interagency noise effects research panel. Projects are reported under the following subject areas: noise-induced hearing loss; nonauditory health effects; psychological and performance effects; noise effects on sleep, communication interference; community or collective response; effects of noise on domestic

animals and wildlife; noise environment determination; and noise concomitant with vibration. GRA

N78-29651# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF MERCURY POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Elizabeth A. Harrison May 1978 206 p Supersedes NTIS/PS-77/0415; NTIS/PS-76/0343; NTIS/PS-75/210
(NTIS/PS-78/0496/6; NTIS/PS-77/0415; NTIS/PS-76/0343; NTIS/PS-75/210) Avail: NTIS HC $28.00/MF $28.00 CSCL 06T

This bibliography contains 200 abstracts. Mercury toxicity, poisoning, absorption, excretion, bioaccumulation, and concentration levels in various plants, animals, microorganisms, and humans are covered. Toxic hazards, occupational safety and health, microbial degradation and environmental health are included. GRA

N78-29652# Versar, Inc., Springfield, Va.
EVALUATION OF A TECHNIQUE FOR SAMPLING LOW CONCENTRATIONS OF ORGANIC VAPORS IN AMBIENT AIR Final Report
F. C. Whitmore, M. N. Khattak, J. D. Barden, and R. L. Durfee 1977 30 p
(Contract EPA-68-02-2618)
(PB-279672/0) Avail: NTIS HC A03/MF A01 CSCL 14B

Following contamination of a wastewater treatment plant by hexachlorocyclopentadiene and octachlorocyclopentene, large volumes of these contaminants were isolated on the plant site. An extensive program of monitoring ambient air was developed for the protection of plant personnel and the general public during destruction of the material with on-site equipment. The technique used to monitor the air is described and compared technique with OSHA routine air monitoring techniques used in the workplace. GRA

N78-29653# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Natural Resources.
RESEARCH AND DEVELOPMENT IN THE ENVIRONMENTAL PROTECTION AGENCY, VOLUME 3
Jun. 1977 112 p refs
(Contract EPA-68-01-2430)
(PB-279370/1; ISBN-0-309-02617-2) Avail: NTIS HC A06/MF A01 CSCL 13B

Some of the following are discussed: (1) Environmental protection and research; (2) Scientific and technical activities in environmental research; (3) Development and standardization of measurement technology; (4) Design of monitoring systems; and (5) Characterization of pollutants and discharges. GRA

N78-29654# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.
ACTIVATED CARBON ADSORPTION OF TRACE ORGANIC COMPOUNDS Final Report, 6 Jan. 1975 - 5 Jul. 1977
Vernon L. Snoeyink, John J. McCreary, and Carol J. Murin Dec. 1977 129 p refs
(Grant EPA-R-803473)
(PB-279253/9; EPA-600/2-77-223) Avail: NTIS HC A07/MF A01 CSCL 13B

Research was conducted to determine how effectively humic substances and the trace contaminants 2-methylisoborneol (MIB), geosmin, the chlorophenols and polynuclear aromatic hydrocarbons were adsorbed by activated carbon under the competitive adsorption conditions encountered in natural waters. The naturally occurring odorous compounds were found to be much more strongly adsorbed than the humic substances. Both the chlorophenols and the polynuclear aromatic hydrocarbons are very strongly adsorbed. Strong competition was observed between anionic and neutral species of 2,4-dichlorophenol and 2,4,6-trichlorophenol. GRA

N78-29655# Midwest Research Inst., Kansas City, Mo.
ST. LOUIS DEMONSTRATION: POWER PLANT EQUIPMENT, FACILITIES AND ENVIRONMENTAL EVALUATIONS Final Progress Report, Oct. 1974 - Nov. 1975
P. G. Gorman, L. J. Shannon, M. P. Schrag, and D. E. Fiscus Dec. 1977 433 p refs
(Contracts EPA-68-02-1324; EPA-68-02-1871)
(PB-279828/8; EPA-600/2-77-155B) Avail: NTIS HC A19/MF A01 CSCL 07A

The results of the evaluation of the equipment and facilities for the firing of refuse-derived fuel and the assessment of the gaseous aqueous, and solid waste discharges associated with firing refuse-derived fuel during the St. Louis-Union Electric Refuse Fuel Project are described. A corner fired pulverized coal boiler with a nominal 125 MW generating rate was used for the test program. A major portion of the effort was directed to the assessment of the emissions and potential environmental impacts associated with the burning of coal plus refuse derived fuel in the boiler, including an assessment of the efficiency of the electrostatic precipitator used as a pollution control device. GRA

N78-29656# Air Pollution Technology, Inc., San Diego, Calif.
EVALUATION OF THREE INDUSTRIAL PARTICULATE SCRUBBERS Final Report, Mar. 1975 - Dec. 1977
Seymour Calvert, Harry F. Barbarika, and Gary M. Monahan Feb. 1978 99 p refs
(Contract EPA-68-02-1869)
(PB-279572/2; EPA-600/2-78/032) Avail: NTIS HC A05/MF A01 CSCL 07A

Results of field measurements, carried out on three full scale industrial scrubbers to determine scrubber performance characteristics, including particle collection efficiency as a function of particle diameter are presented. The three scrubbers were different gas-atomized spray types with pressure drops ranging from 54 to 178 cm W.C. Their performance on major sources of fine particle emissions was compared to a mathematical performance model for venturi scrubbers. GRA

N78-29657# California State Dept. of Transportation, Sacramento.
AIR POLLUTION AND ROADWAY LOCATION, DESIGN AND OPERATION PROJECT OVERVIEW Final Report, Jul. 1971 - Jul. 1977
G. R. Bemis, P. E. Benson, A. J. Ranzieri, and K. O. Pinkerman Sep. 1977 140 p refs
(Contract DOT-FH-11-7730)
(PB-279395/8; FHWA-RD-77-102; Rept-19701-657218) Avail: NTIS HC A07/MF A01 CSCL 04A

An overview of an air quality study to establish an extensive data base for primary pollutants emitted from freeways of various configurations, at-grade, depressed and elevated in the Los Angeles Basin is presented. A line source microscale model to predict the dispersion of pollutants, CALINE 2, was developed, validated, and improved. Air pollutants sampled included carbon monoxide (CO), reactive and unreactive hydrocarbons (RHC, URHC), oxides of nitrogen (NOx), ozone (O3), sulphur dioxide (SO2), and hydrogen sulfide (H2S). Traffic volume data were obtained. Particulate sampling was conducted to obtain total particulates, lead, and various other elements. GRA

N78-29658# Texas Univ. at Austin. Dept. of Chemical Engineering.
HOUSTON URBAN PLUME STUDY: 1974, DESCRIPTION AND DATA Final Report
James R. Brock Apr. 1978 259 p refs
(Grant EPA-R-803660)
(PB-279409/7; EPA-600/3-78-048B) Avail: NTIS HC A12/MF A01 CSCL 13B

The 1974 Houston Urban Plume Study (HUPS) was undertaken as a preliminary investigation of some of the unresolved features of Houston's air pollution problem. Aerial measurements were made of the principal pollutants (SO2, NOx, O3, CO, aerosol) of the Houston area. Wind-field measurements were also made. These data were used to estimate pollutant budgets. Values for SO2 and NOx (14 metric tons/hr and 40 metric tons/hr, respectively) were reasonably comparable with values derived from emissions inventories of the Texas Air Control Board (13 and 24 metric tons/hr, respectively). On the basis of the limited sampling period, the industrial area (east of downtown Houston) apparently is the major contributor of primary air pollutants in the Houston area. In the morning hours above the mixed layer, relatively large ozone concentrations (max. 0.2 ppm)--almost certainly of photochemical--origin were found that correlated

closely with light scattering aerosol, thus indicating the existence above the mixed layer of strong secondary aerosol sources. GRA

N78-29659# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Medical and Biological Effects of Environmental Pollutants.
MEDICAL AND BIOLOGIC EFFECTS OF ENVIRONMENTAL POLLUTANTS PLATINUM-GROUP METALS
Nov. 1977 138 p refs
(Contract EPA-68-02-1226)
(PB-279464/2; ISBN-0-309-02640-7) Avail: NTIS HC A07/MF A01 CSCL 06F

Pertinent information (up to April 1976) about the effects on man and his environment are presented that result either directly or indirectly from pollution by platinum-group metals; iridium, osmium, palladium, platinum, rhodium, and ruthenium. The physical and chemical properties, sources, measurement, and effects of plants, animals, and humans are described. The information presented is supported by references to the scientific literature, and the summary, conclusions, and recommendations represent a consensus of the members of the Subcommittee. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-29660 Engineering Sciences Data Unit, London (England).
PHYSICAL PROPERTIES OF DESIGN ATMOSPHERES
Jan. 1978 7 p
(ESDU-78008; ISBN-0-85679-210-1) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $146.50

Data are given for the variation of relative density and temperature with pressure altitude for five standard design atmospheres. These five atmospheres corresponded to the maximum and minimum temperature conditions within the tropical, temperate, and Arctic geographical zones and to the international Standard Atmosphere. The tropical, temperate, and Arctic extremes were drawn up on the basis of conditions unlikely to be exceeded more often than one day per year at a given pressure altitude and were defined. They were intended primarily for use in designing an aeroplane's structure and equipment and do not correspond to coherent atmospheres likely to be encountered in reality. ESDU

N78-29661 Wisconsin Univ. - Madison.
PHOTOABSORPTION AND PHOTOIONIZATION MEASUREMENTS ON CONSTITUENT ATMOSPHERIC GASES IN THE EXTREME VUV Ph.D. Thesis
Barrett Ewing Cole 1978 174 p
Avail: Univ. Microfilms Order No. 7806415

Four distinct measurements were performed between 50 and 340 A on gases which are constituents of the upper atmosphere. All experimental work was done using Synchrotron radiation and a specially designed double Vodar monochromator. Photoabsorption cross sections were obtained for ten chloro-fluoro methanes and ethanes between 50 and 100 A. In addition to observing broad continuum absorption, the excitation of Cl 2p electrons to bound molecular states is also seen. Accurate absorption cross sections were obtained for N2, O2, NO, N2O and CO between 50 and 340 A where a resonance structure is known to exist. Double ionization yield measurements were obtained on N2 between 180 and 300 A and tend to confirm that the N2 resonance feature is not caused by double ionization although double ionization is seen at the shorter wavelengths studied. A fluorescence experiment is analyzed in terms of the preferential excitation of ground state N2 by electrons originating from the 2g orbital in N2. Dissert. Abstr.

N78-29662 Nevada Univ., Reno.
ICE CRYSTAL GROWTH IN A DYNAMIC THERMAL DIFFUSION CHAMBER Ph.D. Thesis
Vernon Wilfred Keller 1977 215 p
Avail: Univ. Microfilms Order No. 7810013

Ice crystals were grown in a supersaturated environment produced by a dynamic thermal diffusion chamber, which employed two horizontal plates separated by a distance of 2.5 cm. Air was circulated between and along the 1.2 m length of the plates past ice crystals which nucleated and grew from a fiber suspended vertically between the two plates. Using a zoom stereo microscope, the variation of the shape and linear growth rate of ice crystals was examined as a function of the ambient temperature, the ambient supersaturation, and the forced ventilation velocity. Results from these experiments are interpreted in terms of diffusion through a local boundary layer, whose thickness is a function of ventilation velocity, the diffusivity of water vapor and heat through air, and the crystal shape; and interaction with different nucleation and growth kinetics on different surfaces. Dissert. Abstr.

N78-29663*# Lunar and Planetary Inst., Houston, Tex.
PAPERS PRESENTED TO THE CONFERENCE ON PLATEAU UPLIFT: MODE AND MECHANISM
1978 92 p Conf. held at Flagstaff, Ariz., 14-16 Aug. 1978; co-sponsored by the Intern. Comm. on Geodyn., Working Group 7
(Contract NSR-09-051-001)
(NASA-CR-157468; LPI-Contrib-329) Avail: NTIS HC A05/MF A01 CSCL 08G

Papers concerning plateau uplift are presented. The areas considered include: Colorado, Mexico, Europe, India, Utah, and South America. F.O.S.

N78-29664*# California Inst. of Tech., Pasadena. Seismological Lab.
A LOCAL EARTHQUAKE CODA MAGNITUDE AND ITS RELATION TO DURATION, MOMENT M SUB O, AND LOCAL RICHTER MAGNITUDE M SUB L
Anne M. Suteau and James H. Whitcomb 1977 35 p refs
(Grant NsG-5224; Contracts JPL-64598; DI-14-08-0001-16719)
(NASA-CR-157473) Avail: NTIS HC A03/MF A01 CSCL 08K

A relationship was found between the seismic moment, M sub O, of shallow local earthquakes and the total duration of the signal, t, in seconds, measured from the earthquakes origin time, assuming that the end of the coda is composed of backscattering surface waves due to lateral heterogenity in the shallow crust following Aki. Using the linear relationship between the logarithm of M sub O and the local Richter magnitude M sub L, a relationship between M sub L and t, was found. This relationship was used to calculate a coda magnitude M sub C which was compared to M sub L for Southern California earthquakes which occurred during the period from 1972 to 1975. J.M.S.

N78-29665*# Illinois Univ., Urbana. Aeronomy Lab.
ENERGETIC PARTICLES AND IONIZATION IN THE NIGHTTIME MIDDLE AND LOW LATITUDE IONOSPHERE
H. D. Voss and L. G. Smith 1 Nov. 1977 323 p refs
(Grant NGR-14-005-181)
(NASA-CR-156943; ISSN-0568-0581; Rept-78; UILU-ENG-77-2502) Avail: NTIS HC A14/MF A01 CSCL 04A

Seven Nike Apache rockets, each equipped with an energetic particle spectrometer ($12 < E < 80$ keV) and electron-density experiments, were launched from Wallops Island, Virginia and Chilca, Peru, under varying geomagnetic conditions near midnight. At Wallops Island the energetic particle flux ($E < 40$ keV) is found to be strongly dependent on Kp. The pitch-angle distribution is asymmetrical about a peak at 90 D signifying a predominately quasi-trapped flux and explaining the linear increase of count rate with altitute in the altitude region 120 to 200 km. The height-averaged ionization rates derived from the electron-density profiles are consistent with the rates calculated from the observed total particle flux for magnetic index $K_p > 3$. In the region 90 to 110 km it is found that the nighttime ionization is primarily a result of Ly-beta radiation from the geocorona and interplanetary hydrogen for even very disturbed conditions. Below 90 km during rather disturbed conditions

energetic electrons can be a significant ionization source. Two energetic particle precipitation zones have been identified at midlatitudes. F.O.S.

N78-29666# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE MAINTENANCE OF WALKER CIRCULATION
V. Brahmananda Rao and Valdo S. Marques May 1978 17 p refs Submitted for publication
(INPE-1260-PE/136) Avail: NTIS HC A02/MF A01

From the point of view of energetics, the available potential energy generated by condensation heating was converted into the kinetic energy of the Walker circulation. This required that the rising (sinking) motion should be associated with higher (lower) temperature. Such an association between the vertical velocity and temperature was verified in the case of Walker circulation of the Pacific and Atlantic sectors. J.A.M.

N78-29667# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SIMULTANEOUS OBSERVATIONS OF THE Na 5893A
B. R. Clemesha, V. W. J. H. Kirchhoff, and D. M. Simonich Jul. 1977 22 p refs
(INPE-1081-PE/067) Avail: NTIS HC A02/MF A01

Simultaneous lidar observations of the vertical distribution of sodium in the mesosphere and the intensity of the sodium nightglow show that variations in the glow are well correlated with perturbations in the sodium density. These perturbations have a wavelike structure, with a vertical wavelength of about 10 km, and show downward phase propagation. On most occasions the airglow is best correlated with the density of 88 km, which is about 4 km below the average height of maximum sodium concentration. It is shown that, on the average, a layer 10 km wide centered on 89 km best explains the observed variations. Using current models for atomic oxygen and ozone, it is shown that such a distribution is in good agreement with the Chapman mechanism for the sodium nightglow with respect to its height and width, but that the calculated emission is about 50 times too small. Author

N78-29668*# Ohio State Univ., Columbus. ElectroScience Lab.
GAIN DEGRADATION AND AMPLITUDE SCINTILLATION DUE TO TROPOSPHERIC TURBULENCE
D. M. Theobold and D. B. Hodge Feb. 1978 61 p refs
(Contract NAS5-22575)
(NASA-CR-156796; ESL-784299-6) Avail: NTIS HC A04/MF A01 CSCL 04A

It is shown that a simple physical model is adequate for the prediction of the long term statistics of both the reduced signal levels and increased peak-to-peak fluctuations. The model is based on conventional atmospheric turbulence theory and incorporates both amplitude and angle of arrival fluctuations. This model predicts the average variance of signals observed under clear air conditions at low elevation angles on earth-space paths at 2, 7.3, 20 and 30 GHz. Design curves based on this model for gain degradation, realizable gain, amplitude fluctuation as a function of antenna aperture size, frequency, and either terrestrial path length or earth-space path elevation angle are presented. L.S.

N78-29669*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPLORATORY MEETING ON ATMOSPHERIC ELECTRICITY AND SEVERE STORMS
William W. Vaughan, ed. Jul. 1978 30 p refs Meeting held at Huntsville, Ala., 10-11 Apr. 1978
(NASA-CP-2056) Avail: NTIS HC A03/MF A01 CSCL 04A

The meeting was arranged to discuss atmospheric electricity and its relationship to severe storms, the feasibility of developing a set of instruments for either a Space Shuttle or an unmanned satellite, and the scientific rationale which would warrant further in-depth assessment, involvement and development of supporting activities by NASA. L.S.

N78-29670# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DYNAMICS OF STRATOSPHERIC WINDS IN THE SOUTHERN HEMISPHERE [DINAMICA DOS VENTOS ESTRATOSFERICOS NO HEMISFERIO SUL]
I. M. Martin and N. A. BuiVan Jul. 1977 13 p ref In PORTUGUESE Submitted for publication Sponsored in part by Fundo Nacl. de Dessenvolvimento Cient. e Technol.
(INPE-1065-PE/064) Avail: NTIS HC A02/MF A01

High altitude balloons were used to study the characteristics of stratospheric wind dynamics in the southern hemisphere. Emphasis was placed on data obtained for the areas of San Jose dos Campos, and San Paulo, Brazil for the months of October 1976 to February 1977. Transl. by B.B.

N78-29671# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DIAGNOSTIC MODEL OF EXTRATROPICAL PERTURBATION STUDIES [UM MODELO DE DIAGNOSTICO PARA ESTUDO DE PERTURBACOES EXTRATROPICAIS]
Maria Regina DaSilvaAragao Sep. 1977 34 p refs In PORTUGUESE; ENGLISH summary Presented at Seminar. Internacl. Sobre Climatol. do Hemisferio sul, Campinas, 5-9 Sep. 1977
(INPE-1108-PE/082) Avail: NTIS HC A03/MF A01

A multilevel diagnostic model developed for the study of the structure and behavior of the extratropical synoptic systems over the Southern Hemisphere is described, the vertical p-velocity is accounted for by using the quasi-geostrophic omega equation which includes the effect of latent heat release. Friction and orography contributions are also included in the model through a 1000 mb boundary condition. When applied to a synoptic system, quantitative information is given regarding the vertical velocity resulting from: (1) latent heat release; (2) thermal advection; (3) differential vorticity advection; (4) friction; and (5) orography. J.M.S.

N78-29672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NONLINEAR LANDAU DAMPING IN THE IONOSPHERE
Yasuhito Kiwamoto and Robert F. Benson Jul. 1978 35 p refs Submitted for publication
(NASA-TM-79595) Avail: NTIS HC A03/MF A01 CSCL 04A

A model is presented to explain the non-resonant waves which give rise to the diffuse resonance observed near 3/2 f sub H by the Alouette and ISIS topside sounders, where f sub H is the ambient electron cyclotron frequency. In a strictly linear analysis, these instability driven waves will decay due to Landau damping on a time scale much shorter than the observed time duration of the diffuse resonance. Calculations of the nonlinear wave particle coupling coefficients, however, indicate that the diffuse resonance wave can be maintained by the nonlinear Landau damping of the sounder stimulated 2f sub H wave. The time duration of the diffuse resonance is determined by the transit time of the instability generated and nonlinearly maintained diffuse resonance wave from the remote short lived hot region back to the antenna. The model is consistent with the Alouette/ISIS observations, and clearly demonstrates the existence of nonlinear wave-particle interactions in the ionosphere. L.S.

N78-29673*# California Inst. of Tech., Pasadena.
APPLICATION OF NORMAL MODE THEORY TO SEISMIC SOURCE AND STRUCTURE PROBLEMS: SEISMIC INVESTIGATIONS OF UPPER MANTLE LATERAL HETEROGENEITY Ph.D. Thesis
Emile Andre Okal 1978 260 p refs
(Grant NGL-05-002-069)
(NASA-CR-157354) Avail: NTIS HC A12/MF A01 CSCL 08K

The theory of the normal modes of the earth is investigated and used to build synthetic seismograms in order to solve source and structural problems. A study is made of the physical properties of spheroidal modes leading to a rational classification. Two problems addressed are the observability of deep isotropic seismic sources and the investigation of the physical properties of the earth in the neighborhood of the Core-Mantle boundary, using SH waves diffracted at the core's surface. Data sets of seismic body and surface waves are used in a search for possible deep lateral heterogeneities in the mantle. In both cases, it is found that seismic data do not require structural differences between oceans and continents to extend deeper than 250 km.

In general, differences between oceans and continents are found to be on the same order of magnitude as the intrinsic lateral heterogeneity in the oceanic plate brought about by the aging of the oceanic lithosphere. L.S.

N78-29674*# Maya Development Corp., San Diego, Calif.
STUDY OF EFFECTS OF SPACE POWER SATELLITES ON LIFE SUPPORT FUNCTIONS OF THE EARTH'S MAGNETOSPHERE Final Report
Marvin Douglas, Robert Laquey, Sherman DeForest, Charles Lindsey, and Howard Warshaw 5 May 1977 152 p refs
(Contracts NAS7-100; JPL-954663)
(NASA-CR-156948; Rept-77-1-1) Avail: NTIS HC A08/MF A01 CSCL 04A

The effects of the Satellite Solar Power System (SSPS) on the life support functions of the earth's magnetosphere were investigated. Topics considered include: (1) thruster effluent effects on the magnetosphere; (2) biological consequences of SSPS reflected light; (3) impact on earth bound astronomy; (4) catastrophic failure and debris; (5) satellite induced processes; and (6) microwave power transmission. Several impacts are identified and recommendations for further studies are provided. J.M.S.

N78-29675*# California Inst. of Tech., Pasadena. Seismological Lab.
REGIONAL VARIATIONS IN UPPER MANTLE COMPRESSIONAL VELOCITIES BENEATH SOUTHERN CALIFORNIA, 1. POST-SHOCK TEMPERATURES: THEIR EXPERIMENTAL DETERMINATION,CALCULATION, AND IMPLICATIONS, 2. Ph.D. Thesis
Susan Ann Raikes 23 May 1978 315 p refs
(Grant NGL-05-002-105; Contracts DI-14-08-0001-15893; DI-14-08-0001-16711; Grant NSF DES-75-03643)
Avail: NTIS HC A14/MF A01 CSCL 08G

The compressional velocity within the upper mantle beneath Southern California is investigated through observations of the dependence of teleseismic P-delays at all stations of the array on the distance and azimuth to the event. The variation of residuals with azimuth was found to be as large as 1.3 sec at a single station; the delays were stable as a function of time, and no evidence was found for temporal velocity variations related to seismic activity in the area. These delays were used in the construction of models for the upper mantle P-velocity structure to depths of 150 km, both by ray tracing and inversion techniques. The models exhibit considerable lateral heterogeneity including a region of low velocity beneath the Imperial Valley, and regions of increased velocity beneath the Sierra Nevada and much of the Transverse Ranges. The development is described of a technique for the experimental determination of post-shock temperatures, and its application to several metals and silicates shocked to pressures in the range 5 to 30 GPa. The technique utilizes an infra-red radiation detector to determine the brightness temperature of the free surface of the sample after the shock wave has passed through it. F.O.S.

N78-29676# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
IONOSPHERIC ELECTRICAL FIELDS [CAMPOS ELECTRICOS NA REGIAO IONIZADA DA ATMOSFERA]
V. W. J. H. Kirchhoff Oct. 1977 26 p refs In PORTUGUESE; ENGLISH summary
(INPE-1144-PE/098) Avail: NTIS HC A03/MF A01

The properties and origin of the ionospheric electric fields are reviewed. The early theoretical calculations of electric fields, based on the geomagnetic variations are discussed, as well as the most recent measurements made by various techniques. Some of the most striking effects, caused by ionospheric electric fields, are pointed out. Author

N78-29677# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NIGHTGLOW MEDIUMS (5893A) AND THEIR CORRELATION WITH ATMOSPHERIC SODIUM CONCENTRATION [MEDIDAS DE LUMINESCENCIA NOTURNA (LAMBDA 5893) E SUA CORRELACAO COM A ABUNDANCIA DO SODIO ATMOSFERICO]
V. W. J. H. Kirchhoff and D. M. Simonich May 1977 12 p refs In PORTUGUESE
(INPE-1032-PE/057) Avail: NTIS HC A02/MF A01

Variations in nocturnal luminescence of 5893A were studied by means of neutral sodium density using radar. An analysis of the June to August, 1976 data shows that there is good correlation of the luminescent variations with the sodium abundance. This characteristic is maintained during the periods of perturbations. The variations are at a minimum at night. Variations in abundance for altitudes above 90 km precede the variations in luminescence. Transl. by F.O.S.

N78-29678# Michigan Univ., Ann Arbor. Space Physics Research Lab.
NONLINEAR ANALYSIS OF PLASMA INSTABILITY EXCITED BY THE AURORAL ELECTROJET Final Report, 1 Oct. 1976 - 31 Dec. 1977
E. G. Fontheim, K. S. Hwang, and R. S. B. Ong Hanscom AFB, Mass. AFGL 24 Jan. 1978 21 p refs
(Contract F19628-77-C-0008; AF Proj. 2311)
(AD-A053647; AFGL-TR-78-0022) Avail: NTIS HC A02/MF A01 CSCL 04/1

The two-fluid (electron and ion) continuity and momentum equations are expanded in terms of the amplitudes of the fluctuations, and the nonlinear dispersion relation is derived. From this expression the threshold condition (when the growth rate = 0) as well as the condition for instability (when the growth rate < 0) are obtained. In addition, the order of magnitude of the density fluctuations is estimated which agrees with that observed by Booker. It is shown that these results can be obtained only with the nonlinear theory. Finally, it is shown that as a result of electric field measurements by Kelley and Mozer our theory predicts that the wave propagation vector of the irregularities must have a small, but nonvanishing, component parallel to the east-west direction. Author (GRA)

N78-29679# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SOME ELEMENTS OF ICEBERG TECHNOLOGY
W. F. Weeks and Malcolm Mellor Mar. 1978 38 p refs
(AD-A053431; CRREL-78-2) Avail: NTIS HC A03/MF A01 CSCL 08/12

Many of the technical questions relating to iceberg transport are given brief, but quantitative, consideration. These include iceberg genesis and properties, the mechanical stability of icebergs at sea, towing forces and tug characteristics, drag coefficients, ablation rates, and handling and processing the iceberg at both the pick-up site and at the final destination. In particular the paper attempts to make technical information on glaciological and ice engineering aspects of the problem more readily available to the interested planner or engineer. Specific conclusions include: (1) No unprotected iceberg, no matter how long or wide, would be likely to survive the ablation caused by a long trip to low latitudes. (2) Icebergs that have a horizontal dimension exceeding 2 km may well be prone to breakup by long wavelength swells. (3) To avoid the dangers associated with an iceberg capsizing, the width of a 200 m thick iceberg should always be more than 300 m. (4) For towing efficiency the length/width ratio of a towed iceberg should be appreciably greater than unity. (5) For a pilot project, the selected iceberg would have to be quite small, if for no other reason than the practical availability of tug power. Author (GRA)

N78-29680# Boston Univ., Mass. Dept. of Astronomy.
NUMERICAL SIMULATION OF IONOSPHERIC AND PLASMASPHERIC DYNAMICS Final Scientific Report, 10 Oct. 1976 - 30 Sep. 1977
M. Mendillo, C. C. Chacko, B. Vance, F. X. Lynch, and B. Balko Jan. 1978 45 p refs
(Contract F19628-77-C-0019)
(AD-A053451; AFGL-TR-78-0026) Avail: NTIS HC A03/MF A01 CSCL 04/1

The development of computational schemes for numerical modelling of the plasmapause and the aurorally-induced plasma density gradients is described. Variations in location of the equatorial plasmapause are simulated using computer-generated maps representing an ensemble of test particles evolving under co-rotational and convection electric fields. The model has been used to estimate the Transition Time (T sub p) from one stable,

equilibrium plasmapause configuration to another and to reproduce Disturbance Scenarios wherein the hour-by-hour changes in plasmapause location at a given local time L sub pp(LT) associated with specified variations in geomagnetic activity are followed. The results of calculations using both models show that plasma transport effects either dominate or at least significantly contribute to the spatial and/or temporal characteristics of the plasma density feature in question. GRA

N78-29681# New Mexico Univ., Albuquerque.
APPLICATION OF A SOIL CAP MODEL TO GROUND MOTION ANALYSES Final Report
Joseph J. Fedock Feb. 1978 60 p refs Sponsored in part by the Defense Nuclear Agency
(Contract F29601-76-C-0015)
(AD-A053694; AFWL-TR-77-134) Avail: NTIS HC A04/MF A01 CSCL 19/4

A soil cap model was analyzed and an equation-of-state based on this model was developed and implemented in a one-dimensional, wave-propagation code. The model was used to match laboratory data of a sand material and to estimate the dynamic in-situ properties of a clay material from Cylindrical In-Situ Test (CIST) data. Comparisons were made between the experimental data and the results obtained with the cap model and another constitutive model; both models gave similar results with the cap model providing slightly better agreement with the experimental data. Author (GRA)

N78-29682# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
BENCHMARK-76: MODEL COMPUTATIONS FOR DISTURBED ATMOSPHERIC CONDITIONS. 3: RESULTS FOR SELECTED EXCITATION PARAMETERS AT 60 KM
J. M. Heimerl and F. E. Niles Mar. 1978 52 p refs Supersedes BRL-IMR-510
(DA Proj. 1L1-61102-B-53A)
(AD-A054376; AD-E430022; ARBRL-TR-02051; BRL-IMR-510) Avail: NTIS HC A04/MF A01 CSCL 04/1

Electron, positive and negative ion densities have been computed as a function of time at an altitude of 60 km under conditions where the prompt ionization parameter was assigned the values ten to the eighth, tenth or eleventh power per cubic centimeter and the delayed ionization parameter was assigned the values ten to the sixth, eighth or tenth power ion pairs per cubic centimeter per second, subject to the condition that the magnitude of the former be greater than the magnitude of the latter. Model times extend the 10,000 seconds in most cases and computations were made for daytime and nighttime conditions. Selected results and limited comparisons are reported together with the variations of the computed equivalent rate coefficients with time and with ionization conditions.
Author (GRA)

N78-29683# IRT Corp., San Diego, Calif.
MEASUREMENTS OF SELECTED CHARGE TRANSFER PROCESSES AT LOW ENERGIES Final Report, Mar. - Sep. 1977
R. H. Neynaber, J. A. Rutherford, and D. A. Vroom 17 Oct. 1977 16 p refs
(Contract DNA001-77-C-0202)
(AD-A054360; AD-E300202; IRT-8163-004; DNA-4445F) Avail: NTIS HC A02/MF A01 CSCL 04/1

A crossed beam technique has been used to investigate the charge transfer process N(+) + O yields N + O(+) in the low energy regime (0.5 to 5 eV in the center-of-mass system). Oxygen atoms were formed by three different techniques; thermal dissociation, RF discharge, and microwave discharge. All three sources provided oxygen atoms but certain disadvantages of each complicated the measurement procedure. Preliminary data indicated that the cross section for the process in the energy range of interest is between 5 x 10 to the minus 18th power and 2 x 10 to the minus 17th power sq cm. Author (GRA)

N78-29684# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Res. Lab.
BENCHMARK-76: MODEL COMPUTATIONS FOR DISTURBED ATMOSPHERIC CONDITIONS II. RESULTS FOR THE STRATOSPHERE AND MESOSPHERE
J. M. Heimeral and F. E. Niles Mar. 1978 52 p refs Supersedes BRL-IMr-484
(AD-A054325; ARBRL-TR-02050) Avail: NTIS HC A04/MF A01 CSCL 04/1

Electron, positive ion and negative ion densities have been computed as a function of time and altitude under conditions where the prompt ionization parameter is set to ten to the eleventh power per cubic centimeter and the delayed ionization parameter is taken to be 10 to the eighth power ion-pairs per cubic centimeter per second. Model times extend to 10,000 s for most conditions and the altitude regions are 10-80 km for daytime conditions and 30-80 km for nighttime conditions. Selected results, limited comparisons and brief sensitivity studies are reported together with temporal and altitude variations of the computed effective rate coefficients. Author (GRA)

N78-29685# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
LABORATORY MEASUREMENTS OF SELECTED D-REGION REACTIONS Final Report, 1 Oct. 1976 - 30 Sep. 1977
E. E. Ferguson, F. C. Fehsenfeld, D. L. Albritton, A. L. Schmeltekopf, and C. J. Howard 30 Sep. 1977 10 p
(Contract DNA-IACRO-77-828)
(AD-A054361; AD-E300199; DNA-4443F) Avail: NTIS HC A02/MF A01 CSCL 04/1

The flowing afterglow and flow-draft instrumental laboratory capabilities have been applied during the past year to the experimental investigation of the kinetics and thermochemistry of important D-region atomic and molecular ions. The information obtained will be used to redefine the atmospheric ionic composition and the processes by which this ionic composition may be modified. GRA

N78-29686# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
IN-PLANE DEFORMATION OF NON-COAXIAL PLASTIC SOIL
Shunsuke Takagi Apr. 1978 34 p
(AD-A054217; CRREL-78-7) Avail: NTIS HC A03/MF A01 CSCL 08/13

The theory of non-coaxial in-plane plastic deformation of soils that obey the Coulomb yield criterion is presented. The constitutive equations are derived by use of the geometry of the Mohr circle and the theory of characteristic lines. It is found that, for solving a boundary value problem, the non-coaxial angle must be given such values that enable us to accommodate the presupposed type of flow in the given domain satisfying the given boundary conditions. The non-coaxial angle is contained in the constitutive equations as a parameter. Therefore, the plastic material obeying the Coulomb yield criterion is a singular material whose constitutive equations are not constant with material but are variable with flow conditions. Author (GRA)

N78-29687# California Univ., Livermore. Lawrence Livermore Lab.
PLANE SHOCK WAVE STUDIES OF GEOLOGIC MEDIA
G. D. Anderson and D. B. Larson 31 Oct. 1977 27 p refs
(Contract W-7405-eng-48)
(UCRL-52357) Avail: NTIS HC A03/MF A01

Plane shock wave experiments were conducted on eight geologic materials in an effort to determine the importance of time-dependent mechanical behavior. Of the eight rocks studied, only Westerly granite and nugget sandstone appear to show time independence. In the slightly porous materials (1-5 percent) Blair dolomite and sodium chloride, and in the highly porous (15 to 40 percent) rock, Mt. Helen tuff and Indiana limestone, time-dependent behavior is associated with the time required to close the available porosity. In water-saturated rocks the time dependence arises because the water that is present shows no indication of transformation to the higher pressure ice phases, thus suggesting the possibility that a metastable form of water exists under dynamic conditions. ERA

N78-29688# California Univ., Livermore. Lawrence Livermore Lab.
ESTIMATE OF EARTH MEDIA SHEAR STRENGTH AT THE NEVADA TEST SITE

R. W. Terhune and H. D. Glenn 3 Nov. 1977 32 p refs
(Contract W-7405-eng-48)
(UCRL-52358) Avail: NTIS HC A03/MF A01

A method is presented of estimating the effective shear strength of the fractured rock that surrounds a nuclear detonation. To do this, the cavity radii from previous detonations are measured. Numerical computer codes are used to model the explosion phenomenology and develop the functional relationship between the normalized cavity displacement and the normalized shear strength of the rock. In this sense, the computer codes serve as replica models that are dimensionally analyzed to interpret the field experience. The effects of gravity and overburden pressure are separated from the effects of the material properties and scaling laws are given for each. It was found that the most frequent shear strengths are between 0.020 and 0.060 kbars. They are also essentially independent of the depth-of-burial ranges considered. There is good agreement between predicted shear strengths and those measured from core samples. ERA

N78-29689# Instituto Geografico y Catastral, Madrid (Spain). Seccion de Geomagnetismo y Aeronomia.

GEOMAGNETIC MAP OF SPAIN FOR 1975 [MAPA GEOMAGNETICO DE ESPANA - EPOCA 1975]

Dec. 1976 43 p In SPANISH Original contains color illustrations
Avail: NTIS HC A03/MF A01

Five maps were drawn computing magnetic data recorded at Logrono, Ebro, Coimbra, Toledo, Almeria,and San Fernando geomagnetic observatories. The maps indicate the isogonic lines; the total, horizontal, and vertical isograms; and the isogonic lines. ESA

N78-29690# Research Inst. of National Defence, Stockholm (Sweden).

MULTIVARIATE LINEAR FUNCTIONAL RELATIONSHIPS: ESTIMATION OF PARAMETERS AND DISCRIMINATION BETWEEN TWO RELATIONSHIPS, WITH A SEISMOLOGICAL APPLICATION

Eva Elvers 1977 11 p refs
(FOA-B-20015-T1; ISBN-91-7056-047-1) Avail: NTIS HC A02/MF A01; Res. Inst. of Natl. Defence, Stockholm Sw.Kr. 5

A chain of five statistical investigations is described, and their origin, which is a seismological discrimination problem, is briefly presented. The first link deals with parameter estimation by the maximum likelihood method and with a modification of it for a class of models, to which ordinary large-sample theory is not applicable due to what is called incidental parameters. Functional relationship models belong to this class, and the chain continues with a more detailed study of the asymptotic estimator behavior for multivariate linear relationships. Next, a general comparison of two discriminants based on samples is made. The fourth link utilizes its two predecessors informing a classification rule for two parallel relationships and evaluating its behavior. Finally, some different ways to take into account also a censored variable in the classification procedure are investigated. The links were made self-dependent, since their results belong methodologically to two statistical areas, each of which is used in different sciences. Seismologically the theoretical results imply an improved discriminatory capability, not only because the point of censoring is utilized but also due to extended possibilities of considering variables individually when estimating parameters of a statistical model and forming a classification rule from the estimates and their accuracy. Author (ESA)

N78-29691# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Piasma Physics.

REVIEW OF MAGNETOSPHERIC BOUNDARY LAYER PHENOMENA AND RELATIONS TO CURRENT THEORIES

Walter J. Heikkila (Texas Univ. at Dallas) and Lars P. Block Nov. 1977 23 p refs Sponsored partly by Swed. Natural Sci. Res. Council and U.S. NSF
(TRITA-EPP-77-25) Avail: NTIS HC A02/MF A01

Recent observations on the magnetopause and boundary layer are reviewed. A region with magnetosheath-like plasma is found in an entry layer inside the magnetopause, at least partly on closed field lines. There is no enhanced flow near the magnetopause, in contrast to what would be expected on the basis of reconnection theories. Inside the magnetopause there is a boundary layer, which must be polarized. Parallel electric fields and currents are involved, thus invalidating the mapping of the electric field along magnetic field lines. Access to the entry layer must be impulsive or diffusive in nature. Author (ESA)

N78-29692# Stockholm Univ. (Sweden). Dept. of Meteorology.

AIR CHEMISTRY MEASUREMENTS IN THE LOWER ATMOSPHERE MADE FROM A SMALL AIRCRAFT - DATA PRESENTATION

Clads Traegaardh Mar. 1978 136 p refs
(Contracts SWED-EPB-7-151/75; SWED-EPB-7-151/76)
(AC-42) Avail: NTIS HC A07/MF A01

A complete list of the data collected within the flight program is presented. Maps of the sampling areas and figures showing the vertical distribution of sulfur dioxide, sulfate, and light scattering from aerosol are presented. Author (ESA)

N78-29693# Geological Survey, Reston, Va. Water Resources Div.

ICE ON RIVERS AND LAKES: A BIBLIOGRAPHIC ESSAY Water Resources Investigations

Eleanore R. Ficke and John F. Ficke Oct. 1977 181 p refs
(PB-279528/4; USGS/WRD/WRI-78-025; USGS/WRI-77-95)
Avail: NTIS HC A09/MF A01 CSCL 08K

This bibliography cites 750 publications. Topics covered include: freezing and melting processes and their prediction and control on rivers, and on lakes; effects of river and lake ice on navigation, flow, and structures; and influences of ice on chemical, biological, and thermal aspects of water quality. GRA

N78-29694# National Academy of Sciences - National Research Council, Washington, D. C.

TRENDS AND OPPORTUNITIES IN SEISMOLOGY

1977 168 p refs Workshop held at the Asilomar Conf. Grounds, Pacific Grove, Calif., 3-9 Jan. 1976
(PB-279320/6; ISBN-0-309-02612-1; LC-77-77290) Avail: NTIS MF A01; HC National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418 CSCL 08K

The history, accomplishments, and status of seismology are reviewed. Changing trends in seismological research and applications are assessed and recommendations for future directions are given. GRA

N78-29695# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

MOLECULAR AND PARTICULATE EXTINCTION IN THE ATMOSPHERE BETWEEN 8 AND 15 MICROMETERS WAVELENGTH

R. F. Calfee and V. E. Derr Dec. 1977 141 p
(PB-280773/3; NOAA-DR-ERL-WPL-1; NOAA-78040602)
Avail: NTIS HC A07/MF A01 CSCL 20F

Attenuation factors as a function of humidity and as a function of the particle size distribution and thermodynamic state of the clouds are considered. Graphs and tables of attenuation coefficients for molecular absorption and particulate extinction are presented for the spectral region 8-15 micrometers. Particulate extinction is presented for ice and water spheres for seven cloud size-distribution models. Normalized tables for the extinction coefficients per unit density are given. GRA

N78-29696# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

GEOMAGNETIC DATA FOR APRIL 1978: AE (8) INDICES AND STACKED MAGNETOGRAMS

J. H. Allen, C. C. Abston, and L. D. Morris Feb. 1978 58 p refs
(PB-280730/3; UAG-64; IMS-DATA-Pub-4; NOAA-78032801)
Avail: NTIS HC A04/MF A01 CSCL 04A

Selected geomagnetic variation data for April 1976 are reported. Included are analog records from eight auroral zone stations; preliminary AE indices based on these data; and various related tables, graphs, and statistics. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-29697*# Ocean Data Systems, Inc., Monterey, Calif.
ATMOSPHERIC PREDICTION MODEL SURVEY Final Report
Robert E. Wellck Dec. 1976 216 p refs
(Contracts NAS7-100; JPL-954547)
(NASA-CR-157217) Avail: NTIS HC A10/MF A01 CSCL 04B

As part of the SEASAT Satellite program of NASA, a survey of representative primitive equation atmospheric prediction models that exist in the world today was written for the Jet Propulsion Laboratory. Seventeen models developed by eleven different operational and research centers throughout the world are included in the survey. The surveys are tutorial in nature describing the features of the various models in a systematic manner. F.O.S.

N78-29698*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GROUND WINDS FOR KENNEDY SPACE CENTER, FLORIDA (1978 VERSION)
D. L. Johnson and S. C. Brown Jul. 1978 180 p refs
(NASA-TM-78181) Avail: NTIS HC A09/MF A01 CSCL 04B

Ground level runway wind statistics are presented for the Kennedy Space Center, Florida area. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the Kennedy Space Center Space Shuttle runway. This document supersedes NASA CR-128995 and should be used in place of it. L.S.

N78-29699*# Systems Technology, Inc., Mountain View, Calif.
SIMULATION AND ANALYSIS OF WIND SHEAR HAZARD Final Report, Jun. 1976 - Oct. 1977
John M. Lehman, Robert K. Heffley, and Warren F. Clement Dec. 1977 156 p refs
(Contract NAS2-8889)
(NASA-CR-157470; AD-A052435; STI-TR-1063-3; FAA-RD-78-7) Avail: NTIS HC A08/MF A01 CSCL 01B

The results of an unmanned simulation and an analysis of wind shear hazard are presented. The study involved the application of mathematical models of four diverse passenger aircraft types ranging from a small STOL commuter aircraft to a jumbo jet and of pilot models appropriate to each flight situation. The hazard to each aircraft was evaluated for both approach and takeoff in three severe wind shear profiles. The effects of varying operational techniques and propulsion system features were investigated and explained with the aid of a simplified linear analysis. No direct correspondence was found between wind shear hazard and aircraft size or type, per se. Instead, the main factors affecting sensitivity to wind shear were shown to be airspeed, flight path regulation, and airspeed regulation. Also, the shear dependency as modeled in the simulation was found to be important. Author

N78-29700# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROCEDURES TO ACCOMPLISH QUALITY CONTROL OF METEOROLOGICAL ALTITUDE DATA [PROCEDIMENTOS PARA EFETUAR O CONTROLE DE QUALIDADE DOS DADOS METEOROLOGICOS DA ALTITUDE]
Heloisa Moreira Torres Nunes and Getulio Soriano de Souza Nunes Sep. 1976 53 p refs In PORTUGUESE
(INPE-1037-NTE/089) Avail: NTIS HC A04/MF A01

Procedures for quality control of meteorological altitude data adapted by INPE were defined. Details of control tests were furnished for technical verification and correction. Transl. by B.B.

N78-29701# Air War Coll., Maxwell AFB, Ala.
AN EXAMINATION OF THE WEATHER GRAPHICS SYSTEM (DIGITAL FACSIMILE) ACQUISITION
Nick G. Tulintseff Apr. 1978 103 p refs
(AD-A053567; RR-504) Avail: NTIS HC A06/MF A01 CSCL 17/2

The acquisition of the Weather Graphics System for disseminating weather information to users worldwide is described and examined from beginning to end. The role and decisions of involved Air Force organizations are highlighted at critical decision points in the implementation process. The lack of technical judgment in assessing the risk of the connecting communications channel and its information capacity is apparent from the test results. A means to isolate the communications channel from the terminal hardware is suggested as a separate implementation task and should be applied to future communications-electronics acquisitions of terminal hardware. Author (GRA)

N78-29702# SRI International Corp., Menlo Park, Calif.
TRACKING AND MONITORING HURRICANES BY HF SKYWAVE RADAR OVER THE GULF OF MEXICO Interim Report
Joseph W. Maresca, Jr. and Christopher T. Carlson Dec. 1977 126 p refs
(Contract F49620-76-C-0023; SRI Proj. 5630)
(AD-A053638; SRI-TR-1; AFOSR-78-0762TR) Avail: NTIS HC A07/MF A01 CSCL 04/2

This report describes the results of a study to evaluate the effectiveness of a high-frequency skywave radar used to determine the track, movement, size, and intensity of hurricanes from ocean gravity waves. Experimental data were collected using the Wide Aperture Research Facility (WARF), a high-resolution skywave radar capable of forming a 1/2 deg. beam at 15 MHz, located in central California. The data were collected for hurricanees Anita, Babe, Caroline, and Eloise in the Gulf of Mexico, and Hurricane Kate in the Pacific Ocean. One or more position estimates were made from radar-derived surface wind direction maps covering a 2 deg. of latitude radius for each hurricane, and agreement to within 10 to 40 km of the National Hurricane Center Best Tracks was found. Both day and night measurements were made, as well as one- and two-ionospheric-hop measurements extending out to ranges of 2800 to 4000 km. Author (GRA)

N78-29703# SRI International Corp., Menlo Park, Calif.
EVALUATION OF THE FIB METHODOLOGY FOR APPLICATION TO CLOUD MOTION WIND DATA Final Report, 23 Jun. 1976 - 23 Jun. 1977
William Viezee, Daniel E. Wolf, and Roy M. Endlich 23 Jul. 1977 92 p refs
(Contract N00228-76-C-3182)
(AD-A053620; SRI-TR-77-08; SRI-ERU-5551) Avail: NTIS HC A05/MF A01 CSCL 04/2

A comprehensive technique for the objective analysis of scalar and vector fields was developed. The technique is called the Fields by Information Blending (FIB) technique. This report describes the results of a research study to evaluate the application of the FIB technique to the blending of satellite-derived cloud motion wind data and their finite-difference derivatives (e.g., vorticity and divergence) with conventional wind analyses. The FIB program was supplied to SRI by NEPRF as part of a set of computer programs that, after adaption to SRI's CDC-6400 computer, allowed for the processing, analyses, and subsequent blending of selected trial data sets. Conclusions are based on the results obtained by executing FIB on the data of two case studies, one of the passage of Hurricane Carmen through the Gulf of Mexico (1-7 September 1974) and the other of migration of an extratropical cyclone in the eastern North Pacific Ocean (5-8 February 1976). Both areas are over water and are relatively sparse in conventional data, so meteorological analyses could benefit from the assimilation of cloud motion data. It is concluded that the FIB program and its associated program segments are operationally suitable for blending cloud motion data with conventional wind analyses. GRA

N78-29704# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
ATMOSPHERIC STRUCTURE WHITE SANDS MISSILE RANGE, NEW MEXICO. PART 6: 25-65 KILOMETERS
Darl McCullough and David J. Novlan Jun. 1977 132 p refs (DA Proj. 1T6-65702-d-127)
(AD-A053568; ECOM-DR-942) Avail: NTIS HC A07/MF A01 CSCL 04/2

Mean monthly vertical profiles of component winds, tempera-

ture, pressure and density are presented in metric units for 25-65 kilometers for White Sands Missile Range, New Mexico. Rocketsonde data are based on period of record 1961-1975.
Author (GRA)

N78-29705# Wyoming Univ., Laramie. Physics and Astronomy.
ASSESSMENT OF ATMOSPHERIC CONDENSATION NUCLEI ASSOCIATED WITH JET AIRCRAFT TRAFFIC Annual Report, May 1977 - Apr. 1978
D. J. Hofmann and J. M. Rosen Apr. 1978 36 p refs
(Contract N00014-76-C-0170)
(AD-A054319; CN-8) Avail: NTIS HC A03/MF A01 CSCL 04/2

The main goal is to determine the source of atmospheric condensation nuclei (CN), the small particle portion of the atmospheric particle size distribution, and to assess the effects of jet aircraft on this particle distribution. In addition, regular measurements of the large sulfate aerosol particles have continued in an effort to assess the source and sink strengths of these particles which are important in the radiative energy balance of the atmosphere. GRA

N78-29706# Naval Postgraduate School, Monterey, Calif.
TROPICAL WAVE DYNAMICS Final Technical Report, 1 Oct. 1975 - 31 Mar. 1978
Chih-Pei Chang and Roger T. Williams Mar. 1978 66 p refs
(Grant NSF DES-75-10719)
(AD-A054302; NPS-63CJ78031) Avail: NTIS HC A04/MF A01 CSCL 04/2

This research may be divided into the following three parts: (1) waves forced by condensation heating in the troposphere, (2) the local barotropic instability produced by a spatially varying basic flow, (3) the numerical modeling of the wave-basic flow interactine system. In the first part, the problem of the vertical structure of tropical waves generated by cumulus heating is treated for the following two cases: (1) heating is controlled by large-scale low-level convergence and (2) heating receives no feedback from large-scale motion. In the first case it is shown that waves which have a short vertical wavelength relative to the vertical scale of heating are stable, and the structure of the most unstable solution is computed. In the second case it is shown that the forcing is most efficient for the longest zonal wavelength and that the most favored vertical wavelength is about twice the vertical scale of the heating. The effect of cumulus damping on planetary-scale Kelvin-like oscillation gives solution which resembles certain observed tropical circulation. GRA

N78-29707# National Defense Univ., Washington, D. C. Research Directorate.
CLIMATE CHANGE TO THE YEAR 2000: A SURVEY OF EXPERT OPINION
Feb. 1978 138 p refs
(ARPA Order 3359)
(AD-A054208) Avail: NTIS MF A01; SOD HC $3.75 CSCL 04/2

Subjective probabilities for the occurrence of specified climatic events were elicited by a survey of 24 climatologists from seven countries. Individual quantitative responses to ten major questions were weighted according to expertise and then averaged, a method of aggregation which preserved the climatologists: collective uncertainty about future climate trends. The aggregated subjective probabilities were used to construct five possible climate scenarios for the year 2000, each having a probability of occurrence. The derived climate scenarios manifest a broad range of perceptions about possible temperature trends to the end of this century, but suggest as most likely a climate resembling the average for the past 30 years. Collectively, the respondents tended to anticipate a slight global warming rather than a cooling. More specifically, their assessments pointed toward only one chance in five that changes in average global temperatures will fall outside the range of -0.3 C to +0.6 C, although any temperature change was generally perceived as being amplified in the higher latitudes of both hemispheres. The respondents also gave fairly strong credence to a 20 to 22 year cycle of drought in the High Plains of the United States but did not agree on its causes. GRA

N78-29708# National Weather Service, Fort Worth, Tex. Southern Region.
THE EFFECT OF WIND AND DEW POINT ON VEGETATIVE WETTING DURATION
Paul D. Smith (National Weather Service Forecast Office, Ruskin, Fla.) Jan. 1978 10 p refs
(PB-280041/5; NOAA-TM-NWS-SR-94; NOAA-78022801) Avail: NTIS HC A02/MF A01 CSCL 04B

The relationship between wind speed, leaf wetness, and type of air mass was examined. Continental Polar Air periodically moves over northeast Florida from October through April. The critical wind speed in the air mass appears to be between 3 and 6 knots. When the average wind speed was less than 5 knots, 10 hours or more of wetting occurred on 88 percent of the nights. With greater than 5 knots of wind less than 8 hours of wetting occurred on 97 percent of the nights. The Maritime Polar air mass is most frequent in northeast Florida from late fall through early spring. GRA

N78-29709# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.
HEATING AND COOLING DEGREE DAYS FOR TENNESSEE
Dewayne L. Ingram (Tenn. Univ., Knoxville) and Henry A. Fribourg (Tenn. Univ., Knoxville) Mar. 1978 28 p refs
(PB-280740/2; NOAA-TM-EDS-24; NOAA-78041215) Avail: NTIS HC A03/MF A01 CSCL 04B

Warm and cold season monthly heating and cooling degree days for 40 Tennessee locations are tabulated for base temperatures 55, 60, 65, and 70 F. A map and brief discussion of Tennessee temperature climate, and a table of mean monthly temperature at these locations are included. The length of record used is 30 yr (1941-1970) for most stations. GRA

N78-29710# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.
PROBABILITY OF LOW AND HIGH TEMPERATURES IN TENNESSEE
Henry A. Fribourg (Tenn. Univ., Knoxville) and Dewayne L. Ingram (Tenn., Univ., Knoxville) Mar. 1978 31 p refs
(PB-280741/0; NOAA-TM-EDS-23; NOAA-78041214) Avail: NTIS HC A03/MF A01 CSCL 04B

The probability of occurrence of 32, 28, 22, and 16 F low temperatures and of 95, 90, 85, and 85 F high temperatures is tabulated by week for 40 Tennessee locations. A map, a brief discussion of Tennessee temperature climate, and a table of mean monthly temperatures at these locations are included. The length of record used is 30 yr (1941-70) for most stations.GRA

N78-29711# National Weather Service, Fort Worth, Tex.
UTILITY OF AGRICULTURAL WEATHER SERVICES IN THE MID-SOUTH
W. E. Rench (Environ. Sci. Studies Center, Stoneville, Ms.) and Frank Makosky (Natl. Weather Serv., Little Rock, Ark.) Feb. 1978 13 p refs
(PB-280943/2; NOAA-TM-NWS-SR-95; NOAA-78032403) Avail: NTIS HC A02/MF A01 CSCL 04B

Agricultural weather services in Arkansas were examined to see what value these products are to farmers and agribusinessmen. Results now show the relative importance of various forecast elements by type of agricultural business. Groups differed in their weather forecast needs. Also, some elements in the agricultural weather forecast proved as important as those in public zone forecasts. The survey results show that some changes in the Arkansas Agricultural Weather Program are needed. GRA

N78-29712# National Oceanic and Atmospheric Administration, Rockville, Md.
NOAA CLIMATE PROGRAM
Dec. 1977 101 p refs
(PB-281195/8; NOAA-78040603) Avail: NTIS HC A06/MF A01 CSCL 04B

The NOAA Climate program is comprised of: impact assessment, climate diagnosis and projection, climate research, observations, and data management. Climate/yield models for certain major crops, climate/energy demand models for natural gas and other fuels, and climate/fisheries productivity models for certain important species are considered. GRA

N78-29713# Decisions and Designs, Inc., McLean, Va.
THE VALUE OF IMPROVED FORECASTS OF CLIMATE FOR AGRICULTURAL DECISION MAKING Final Report
Lawrence D. Phillips, Cameron R. Peterson, and Thomas W. Keelin, III Mar. 1978 159 p refs
(Contract NSF C-76-22517)
(PB-279452/7; PR-77-7-44) Avail: NTIS HC A08/MF A01 CSCL 02B

A large-scale computer simulation of the agricultural system, called AGRIMOD, was used to examine the effects of improved weather forecasts on a large variety of performance indexes, from farm income to food costs for the consumer. Models were developed which related weather indices to weather, weather to predictions of weather, and crop yield to predictions of weather. Thirty crop- and region-specific models were developed so that weather indices could be generated for any scenario of future weather. These models were used in fourteen simulation runs on AGRIMOD. GRA

N78-29714# National Severe Storms Lab., Norman, Okla.
SPRING PROGRAM '76. SECTION 1: METEOROLOGICAL SUMMARY. SECTION 2: DOPPLER RADAR DATA QUALITY CONTROL SUMMARY
R. Alberty, J. Weaver, D. Sirmans, J. Dooley, and B. Bumgarner Dec. 1977 140 p
(PB-280745/1; NOAA-TM-ERL-NSSL-83; NOAA-78041224) Avail: NTIS HC A07/MF A01 CSCL 04B

Surface and upper air measurements supporting storm sampling by both surveillance type and Doppler radars, an instrumented tower, various aircraft, and mobile teams of observers/photographs are presented. Brief descriptions of meteorological events and resulting observations are contained along with illustrative radar and satellite photographs. Tower and rawinsonde data are available in digital tape form and surface data, except for a few selected time intervals which have been digitized; are available as copies of strip charts. An intense effort to document quality control procedures for the two NSSL Doppler radars is described. GRA

N78-29715# National Academy of Sciences - National Research Council, Washington, D. C.
SEVERE STORMS: PREDICTION, DETECTION, AND WARNING. A REPORT OF THE PANEL ON SHORTRANGE PREDICTION AND THE PANEL ON SEVERE STORMS TO THE COMMITTEE ON ATMOSPHERIC SCIENCES ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES.
May 1977 93 p refs
(Contract NSF C-310)
(PB-279306/5; ISBN-0-309-02613-X) Avail: NTIS HC A05/MF A01 CSCL 04B

The problems of dealing with severe convective storm outbreaks are examined. Ways to reduce the human and economic losses resulting from such disasters are suggested. Methods of prediction, monitoring, and warning are included. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-29716 California Univ., San Diego.
STUDY OF SHOALING WAVES IN THE LABORATORY Ph.D. Thesis
Reinhard Eugene Flick 1978 181 p
Avail: Univ. Microfilms Order No. 7810573

Measurements in the shoaling, breaking, and bore regime of single frequency and bifrequency paddle generated waves are presented. Detailed wave height, harmonic amplitude and velocity data suggest that third order Stokes theory that conserves energy flux describes the nonlinear shoaling of single frequency waves from deep water to the breakpoint so long as the waves break before the Ursell number reaches O(1). This is shown to apply roughly to the spilling breaker regime. The wave height and harmonic amplitude growth of plunging type waves is shown to be well predicted by Stokes theory in intermediate depth water. Dissert. Abstr.

N78-29717 British Library Lending Div., Boston Spa (England).
VARIABILITY OF WATER TEMPERATURE IN THE ATLANTIC NEAR THE EQUATOR
B. G. Borisov and B. D. Karelin 1976 10 p refs Transl. into ENGLISH from Akad. Nauk, Sov., Nats. Kom. Prov. PIGAP, Tropeks-74 (Moscow), vol. 2, 1976 p 32-38
(BLLD-M-24959-(5828.4F); BLL-Trans-1309) Avail: British Library Lending Div., Boston Spa, Engl.

Bathythermograph observations of ocean temperature were made at synoptic hours in the 0 to 200 m layer at 5 deg N, 23 deg 30 min W. Temperatures on 11 levels characterizing the upper quasi-homogeneous layer, the layer of discontinuity, and the lower layers were analyzed to determine the variability of subdiurnal variation in water temperature. Mean temperatures, computed for each period, synoptic hour, and level, and the values of vertical distribution of mean water temperature are presented in tables. The time variation of the latitudinal component on the 75 m level is discussed. A.R.H.

N78-29718# Washington Univ., Seattle. Dept. of Oceanography.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. JOINT-II, THE THOMPSON SECTIONS: R/V T. G. THOMPSON CRUISE 108
G. E. Friederich, L. A. Codispoti, M. A. Friebertshauser, and D. D. Bishop Aug. 1977 60 p refs Sponsored by Office of the Intern. Decade of Ocean Exploration, NSF, Wash., D. C.
(PB-279173/9; REF-M77-91; NSF/IDOE-78-32; TR-33) Avail: NTIS HC A04/MF A01 CSCL 08J

Temperature, sigma-t and nutrient sections from hydrographic data collected from the R/V THOMPOSON during Cruise 108 (April-June 1976) are presented. This cruise was part of JOINT-2, a study of the Peruvian upwelling system organized and conducted by the Coastal Upwelling Ecosystems Analysis (CUEA) group. GRA

N78-29719# Centro de Investigacion Cientifica y de Educacion Superior, de Ensenada, B.C. (Mexico). Dept. of Oceanography.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. VERTICAL SECTIONS OF TEMPERATURE, SALINITY AND SIGMA-T. JOINT-II-R/V THOMAS G. THOMPSON CRUISE 108 LEG 1
Jose Ma. Robles P. and Eric D. Barton Aug. 1977 43 p refs Sponsored by Office of the Intern. Decade of Ocean Exploration, NSF, Wash., D. C.
(PB-279174/7; NSF/IDOE-78-33) Avail: NTIS HC A03/MF A01 CSCL 08J

Vertical sections of temperature, salinity and sigma-t from an area near Cabo Nazca, Peru in April-May 1976 are presented. The sections are hand contoured from the complete CTD data set obtained during Leg 1 and the R/V THOMPSON cruise 108. The cruise constituted part of the JOINT II experiment of the Coastal Upwelling Ecosystems Analysis program (CUEA). GRA

N78-29720# National Marine Fisheries Service, Seattle, Wash.
SEASONAL DESCRIPTION OF WINDS AND SURFACE AND BOTTOM SALINITIES AND TEMPERATURES IN THE NORTHERN GULF OF MEXICO Technical Report, Oct. 1972 - Jan. 1976
Perry A. Thompson, Jr. and Thomas D. Leming Feb. 1978 54 p
(PB-280748/5; NOAA-TR-NMFS-SSRF-719;
NOAA-78032401) Avail: NTIS HC A04/MF A01 CSCL 08J

Seasonal surface and bottom salinities and temperatures in the northern Gulf of Mexico are described. The area surveyed, from October 1972 to January 1976, was between Mobile Bay, Alabama (long. 88 D 00 min W) and Atchafalaya Bay, Louisiana (long. 91 D 30 min W), from 5 to 50 fathoms (9 to 91 m). GRA

N78-29721# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
DATA FROM THE ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORIES LOOP CURRENT MONITORING CRUISES MAY 1975 THROUGH AUGUST 1976
Darrell Tidwell, Carol Cardwell, Robert L. Molinari, and Donald Ortman Jan. 1978 242 p

(PB-280772/5; NOAA-TM-ERL-AOML-29; NOAA-78041217) Avail: NTIS HC A11/MF A01 CSCL 08J

Physical oceanographic data collected from May 1975 through August 1976 as part of a study to investigate the circulation in the eastern Gulf of Mexico, and Caribbean Sea are presented. The data reduction techniques are also given. GRA

N78-29722# Washington Univ., Seattle. Dept. of Oceanography.

DEEP OCEAN MINING AND THE ECOLOGY OF THE TROPICAL NORTH PACIFIC

James J. Anderson Jan. 1978 129 p refs

(Grant NOAA-03-06-022-35117)

(PB-279988/0; REF-M78-8; SR-83; NOAA-78031302) Avail: NTIS HC A07/MF A01 CSCL 08A

The oceanography in the intermediate and upper water column of the DOMES area is described and the impact of deep ocean mining on the ecosystem was investigated in a first order manner. The oceanography of the region is described as well as models of the processes controlling the chemical and biological oceanography. Inferences on the impact of mining were made. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-29723*# Battelle Columbus Labs., Ohio.

SPACE LIFE SCIENCES PILOT USER DEVELOPMENT PROGRAM FOR THE MIDWEST REGION Final Report

27 Jul. 1978 43 p

(Contract NAS9-15504)

(NASA-CR-151819) Avail: NTIS HC A03/MF A01 CSCL 06C

The use of space for research by the life science community was promoted through a series of informal one-day seminars with personal follow-up as circumstances dictated. The programs were planned to: (1) describe the space shuttle vehicle and some of its intended uses; (2) discuss problems of manned space flight; (3) stimulate ideas for biological research in space; (4) discuss costs and potential for industrial and; government sponsorship; and (5) show the researcher or corporate planner how to become an active participant in life sciences research in space. An outline of seminar topics is included along with a description of the seminar organization and lists of participants and materials used. A.R.H.

N78-29724*# Louisville Univ. Foundation, Inc., Ky. Health Sciences Center.

SUPPORT OF ASTP/KOSMOS FUNDULUS EMBRYO DEVELOPMENT EXPERIMENT Final Report, 15 Apr. 1975 - 15 Aug. 1977

Peter M. Fuller and J. Richard Keefe 1977 12 p refs

(Contract NAS9-14632)

(NASA-CR-151816) Avail: NTIS HC A02/MF A01 CSCL 06C

Results from the Kosmos Biosatellite 782 flight are presented. Experiments with fish hatchlings are discussed along with postflight observation and testing. The preparation of fertilized eggs for the experiments is described. F.O.S.

N78-29725*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

METHODS FOR MICROBIOLOGICAL AND IMMUNOLOGICAL STUDIES OF SPACE FLIGHT CREWS

Gerald R. Taylor, ed. and S. N. Zaloguev, ed. (USSR Ministry of Health, Moscow) Jul. 1978 180 p refs

(NASA-TM-58185) Avail: NTIS HC A09/MF A01 CSCL 06E

Systematic laboratory procedures compiled as an outgrowth of a joint U.S./U.S.S.R. microbiological-immunological experiment performed during the Apollo-Soyuz Test Project space flight are presented. Included are mutually compatible methods for the identification of aerobic and microaerophilic bacteria, yeast and yeastlike microorganisms, and filamentous fungi; methods for the bacteriophage typing of Staphylococcus aureus; and methods for determining the sensitivity of S. aureus to antibiotics. Immunological methods using blood and immunological and biochemical methods using salivary parotid fluid are also described. Formulas for media and laboratory reagents used are listed. Author

N78-29726# Naval Ship Research and Development Center, Bethesda, Md.

BIODEGRADATION OF SHIPBOARD WASTEWATER IN COLLECTION, HOLDING, AND TRANSFER TANKS

Alexander E. Lardis and Andrew T. Geyer Jan. 1978 85 p refs

(AD-A053643; DTNSRDC-78/041) Avail: NTIS HC A05/MF A01 CSCL 13/10

Eight different waste mixtures representing shipboard holding-tank contents were incubated in test tanks under controlled conditions to determine gas-generation rates and the quantitative effects of varying specific environmental parameters. Indicators of biological activity monitored in the waste mixtures included oxidation/reduction potential, pH, dissolved oxygen, and the concentrations of sulfate, nitrate, and nolatile acids. In addition, concentrations of various gases in the tank ullage were monitored, including oxygen, hydrogen sulfide, carbon dioxide, ethyl mercaptan, methyl mercaptan, carbon monoxide, methane, ammonia, and hydrogen cyanide. Gas-generation rate constants and other relevant data were applied to the development of a gas-generation model capable of predicting the concentrations of potentially hazardous gases in shipboard holding tanks. GRA

N78-29727# Naval Weapons Support Center, Crane, Ind.

SELF DIFFUSION IN CELLS AND TISSUES Annual Report (Final), 1 Oct. 1976 - 30 Sep. 1977

John E. Tanner, Jr. 1 Oct. 1977 49 p refs

(AD-A053422; NWSC/CR/RDTR-73; AR-3) Avail: NTIS HC A03/MF A01 CSCL 06/3

A general treatment of time-dependent (transient) diffusion coefficients in a system of parallel planar barriers of arbitrary permeability has been performed, with emphasis on the results expected for Nuclear Magnetic Resonance (NMR) pulsed-field-gradient, spin-echo measurements. This is the first such derivation for permeable barriers of any geometry. The calculated distribution functions and diffusion coefficients are in agreement with expectations in most of the limiting cases tried, except that an unexplained dependence of the diffusion coefficients on the magnitude of the field gradient was found. The application of the results to the interpretation of experimental results is discussed. GRA

N78-29728# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

NEUTRALIZATION OF ORGANIC SUBSTANCES IN WASTE WATER BY PLANTS

Apr. 1978 7 p Transl. into ENGLISH of Mono. "Obezvrezhivaniye Organicheskikh Veshchestv Stochnykh vod v Rasteniyakh" Kapavna USSR Ministry of Amelioration and Water Utilization, All Union Scientific Research Institute for Utilization of Waste Water in Agriculture, 1975 4 p

(AD-A053435; CRREL-Trans-676) Avail: NTIS HC A02/MF A01 CSCL 06/1

This report discusses the neutralization of organic matter in plants using a highly sensitive method of gas chromatography with a flame ionizing detector. Author (GRA)

N78-29729# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

SEAGRASS LITERATURE SURVEY Final Report

Joseph C. Zieman, Kent M. Bridges, and C. Peter McRoy Jan. 1978 219 p

(Contract DACW39-74-C-0170)

(AD-A054480; WES-TR-D-78-4) Avail: NTIS HC A10/MF A01 CSCL 08/1

An extensive review of the literature pertaining to seagrasses was accomplished through a search of published literature and unpublished documents up to mid 1977. Broad scientific subject areas that relate to seagrasses such as anatomy, ecology, morphology, taxonomy, and physiology were considered together with more specific factors such as substrate selectivity, water quality, productivity, colonization, effect of physical energy (waves, tidal currents, sediment transport), propagation, and tolerance to disturbance. The bibliography is divided into two main reference

sections consisting of a bibliographic citations section and a keyword index section. Also, two supplementary reference sections consisting of an author index section and a source index section appear as appendices in microfiche form. Author (GRA)

N78-29730# Research Inst. of National Defence, Stockholm (Sweden).
INFLUENCE OF MICROWAVES WITHIN THE THERMAL INTENSITY RANGE IN MICE. WEIGHT, RECTAL TEMPERATURE, RESPIRATION, TREAD MILL ACTIVITY, REACTION OF SENSES, AND LEARNING [INVERKAN AV MIKROVAAGOR INOM DET TERMISKA INTENSITETS-OMRAADET PAA MOESS. KROPPSVIKT, REKTALTEMPERATUR, ANDNING, LOEPHJULSAKTIVITET, SINNESREAKTION OCH INLAERNING]
C. O. Criborn Oct. 1977 47 p refs In SWEDISH
(FOA-C-54018-H2/H6) Avail: NTIS HC A03/MF A01

Investigations show that mice exposed to microwave radiation of 2450 MHz, 100 mW/sq cm, for 3 to 6 min, change respiration activity and reaction of senses during exposure. Body temperature increases from 37 to 39 C during exposure. Reaction of senses is cut out after approx. 90 sec, followed by hyperventilation which can cause death in the animals if the exposure is not discontinued within 5 to 6 min. The first 3 days after exposure no negative influence on the tread mill activity or learning was observed. Long term studies of changes in tread mill activity and hemoglobin value showed that a diminution of these parameters occur approx. one week after radiation exposure, which is probably due to injuries of the blood producing organs.
Author (ESA)

N78-29731# Research Inst. of National Defence, Sundbyberg (Sweden).
MILK SECRETION OF Zn-65 IN THE GOAT AFTER ORAL INTAKE OF RADIOZINC
Lars Ekman (Roy. Vet. Coll. of Swed., Stockholm) and Bernt E. V. Jones (Roy. Vet. Coll. of Swed., Stockholm) Nov. 1977 16 p refs
(FOA-C-40069-A3) Avail: NTIS HC A02/MF A01

The metabolism of Zn-65 was studied in seven lactating goats after the administration of 100 to 200 muCi Zn65Cl solution. In blood and milk, Zn-65 was detected 4 hours after the administration of the radio-nuclide. Maximum blood concentration was reached after about 24 hr and in milk after about 48 hr. At this time the concentration was about 0.5% per liter plasma or milk. The milk secretion of Zn-65 accumulated during 7 days varied considerably. The three goats receiving 40 mg a day of dietary zinc secreted 2.7% to 5.8% of the given amount of Zn-65, and the goats receiving 200 mg of stable zinc daily secreted only 0.3% to 0.9%. The accumulated urinary and fecal excretion showed less variation. The four animals studied excreted less than 0.2% in the urine and 65.1% to 91.4% of the given amount in the feces. The concentration of stable zinc ranged from 690 to 1070 mg per liter plasma and from 680 to 1430 mg per liter milk. Author (ESA)

N78-29732# Research Inst. of National Defence, Stockholm (Sweden).
METABOLISM OF 181W-LABELED SODIUM TUNGSTATE IN GOATS
Lars Ekman (Roy. Vet. Coll. of Swed., Stockholm), Horacio D. Figueiras (Roy. Vet. Coll. of Swed., Stockholm), Bernt E. V. Jones (Roy. Vet. Coll. of Swed., Stockholm), and Susumo Myamoto (Roy. Vet. Coll. of Swed., Stockholm) Nov. 1977 20 p refs
(FOA-C-40070-A3) Avail: NTIS HC A02/MF A01

The metabolism of 181-W labeled Na2WO4 in goats was studied because tungsten radionucleides have been detected in fallout in several countries. It was found that a minor part of the ingested 181-W was absorbed in the gastrointestinal tract, the main part, about 95%, was recovered in the feces. The absorbed radiotungsten was mainly in the urine (1.8% to 3.4%) and a small amount was recovered in the milk (0.03% to 0.12%). On autopsy the largest amounts of 181-W were found in the kidneys and liver but large amounts were also found in ribs and some lymph nodes. About 87% was excreted in the urine, 6% in feces and 3% in milk 48 hr after intravenous injection. Intravenous administration was found to give 15 to 20 times higher radioactivity concentration than oral administration. The data obtained suggest that radiotungsten is unlikely to be a significant environmental pollutant source for man as far as its concentration in milk and meat are concerned. ESA

N78-29733# Virginia Inst. of Marine Science, Gloucester Point.
PHYTOPLANKTON SAMPLING IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS Final Special Scientific Report
Paul E. Stofan and George C. Grant Feb. 1978 92 p refs
(Grant EPA-R-804147-01-0)
(PB-279644/9; VIMS-SSR-85; EPA-600/3-78-025) Avail: NTIS HC A06/MF A01 CSCL 13B

An overview of phytoplankton sampling and analysis methods as they apply to quantitative baseline and monitoring surveys is provided. A need for inclusion of a preliminary field survey of the area under investigation and of flexibility in sampling design is stressed. An extensive bibliography pertinent to phytoplankton sampling and analysis is included. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-29734 George Washington Univ., Washington, D. C.
THE FREQUENCY FOLLOWING RESPONSE IN HUMANS Ph.D. Thesis
Michael Stanley Gluck 1978 264 p
Avail: Univ. Microfilms Order No. 7810329

The measurement and recording of good quality responses using surface electrodes, in an ordinary electronics laboratory without electrical or acoustic shielding, is demonstrated. A peak in the amplitude of the response occurs near 500 Hertz. Evidence is presented to show that this peak is not the result of a system artifact, but rather, represents a true evoked response. Several possible explanations are discussed, the most likely being that the various components of the response-the neural frequency following response, the cochlear microphonic, and the response of the post auricular muscle-are in phase at this frequency and add to provide a local maximum in the response. Different methods of measuring the response latency are discussed. It is shown that some aspects of the latency, as well as the response duration show a frequency dependence that is similar to that of the response amplitude. Dissert. Abstr.

N78-29735 California Inst. of Tech., Pasadena.
THE PROCESSING OF VELOCITY INFORMATION BY THE PURSUIT OCULOMOTOR SYSTEM Ph.D. Thesis
Rick Alan Williams 1978 219 p
Avail: Univ. Microfilms Order No. 7810785

A study of human smooth pursuit eye movements was performed in order to clarify the velocity information processing capabilities of the visual system. A set of stimuli were designed which, when presented in motion to the visual system, contained no position information. Thus, the velocity sensitive pursuit system was stimulated in isolation from the saccadic system, which is position sensitive. The smooth eye movements which were elicited by step increases in target velocity from zero velocity were analyzed in detail by a nonlinear least squares curve fitting procedure. Eye velocity was found not to exactly match stimulus velocity, the differences being unsystematic with velocity amplitude or direction. Response latency and the duration of eye acceleration were found to vary about average values of 150 and 300 msec, respectively. Dissert. Abstr.

N78-29736# Siemens A.G., Erlangen (West Germany).
BIOELECTRODES AS SENSORS AND AS POWER SOURCES FOR IMPLANTABLE MEDICAL DEVICES
Gerhard Richter, Erhard Weidlich, and Magdalena Wenzel Dec. 1977 318 p refs In GERMAN; ENGLISH summary
(BMFT-FB-T-77-44) Avail: NTIS HC A14/MF A01

Two types of electrochemical power sources were developed to provide long-term energy for implantable electronic devices: (1) Biogalvanic aluminum-oxygen-cells of the shape and size of a pocket watch (volume 20 ml) have attained in vitro life periods up to 3.1 years. The effective life period is estimated to be

10 years. In an animal experiment a cell performed for 2.2 years delivering approximately 80 micro-W. (2) Biofuel cells utilize the oxidation of body glucose in the process of generating power and are therefore particularly small (volume 3 ml). The older types of cells have been under operation in vitro for over 2 years. In an animal experiment a cell of latest construction achieved 40 micro-W at a cell voltage of 575 mV. This cell had to be explanted after 140 days because of inflammation. F.O.S.

N78-29737# School of Aerospace Medicine, Brooks AFB, Tex.
ALTITUDE DECOMPRESSION SICKNESS: REVIEW OF CONCEPTS IN PRIMARY CARE
Mark E. Speckhard Dec. 1977 22 p refs
(AD-A050849; SAM-Review-4-77; SAM-TR-77-24) Avail: NTIS HC A02/MF A01 CSCL 06/19

Altitude decompression sickness (DCS) was once a major cause of incapacitation in aviators. Preventive measures, including cabin pressurization and denitrogenation, have markedly reduced the incidence of altitude DCS. Most flight surgeons will now see only an infrequent case. Despite limited first-hand experience, the physician who cares for aviators must maintain expertise in the diagnosis and management of altitude DCS. The prognosis associated with expeditious primary care and prompt hyperbaric therapy is excellent. This paper reviews with the flight surgeon concepts in the primary care of altitude DCS. Author (GRA)

N78-29738# IIT Research Inst., Chicago, Ill.
THERMAL MODEL OF LASER-INDUCED SKIN DAMAGE: COMPUTER PROGRAM OPERATOR'S MANUAL Final Report, Sep. 1976 - Apr. 1977
A. N. Takata Dec. 1977 58 p
(Contract F33615-76-C-0608)
(AD-A053416; SAM-TR-77-3723) Avail: NTIS HC A04/MF A01 CSCL 06/18

A user-oriented description is given of a computer program for predicting temperature rises, irreversible damage, and degree of burns caused to skin by laser exposures. This report describes the parameters necessary to run the program and provides suggested values for the parameters. Input data are described in detail as well as the capabilities and limitations of the program. Author (GRA)

N78-29739# School of Aerospace Medicine, Brooks AFB, Tex.
CORNEAL DAMAGE THRESHOLDS FOR INFRARED LASER EXPOSURE: EMPIRICAL DATA, MODEL PREDICTIONS, AND SAFETY STANDARDS Final Report, Apr. 1975 - Jun. 1977
David E. Egbert and Edward F. Maher Dec. 1977 64 p refs
(AD-A049946; SAM-TR-77-29) Avail: NTIS HC A04/MF A01 CSCL 06/18

Experimental damage threshold data for corneal injury from infrared lasers are compared with thermal model predictions of temperature rise, lesion radius, and damage threshold using several damage criteria. The functional dependence of the threshold exposure upon damage end-point, damage criteria, absorption coefficient, beam radius, exposure duration, and damage site is determined. Experimental and predicted thresholds are compared to the ANSI Z136.1-1976 laser safety standard. Similar analysis with the thermal model for applications such as photokeratoplasty or corneal and lenticular spectroscopy can yield alternative approaches to either maximize or avoid thermal effects often inherent in such research. Author (GRA)

N78-29740# Harry Diamond Labs., Adelphi, Md.
SOLID-STATE ULTRASONIC CATHETER-TIP FLOWMETER
Don R. Pardue and Charles L. Coleman Dec. 1977 18 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A050963; HDL-TM-77-38) Avail: NTIS HC A02/MF A01 CSCL 06/12

A blood flowmeter measures the difference in upstream and downstream transit times for short bursts of 10 MHz ultrasound with the two transducers required mounted in a catheter tip. This instrument can measure flow as small as 0.1 cm/s, with a response time of 5 ms. A method is proposed to measure the cross-sectional area of the vessel so that the volume flow rate and the flow velocity can be determined. Author (GRA)

N78-29741# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
TOPICAL HAZARD EVALUATION PROGRAM OF CANDIDATE INSECT REPELLENT AI3-36331, US DEPARTMENT OF AGRICULTURE PROPRIETY COMPOUND Final Report, May 1976 - Dec. 1977
Maurice H. Weeks and Brenda J. DeSena 18 May 1978 10 p
(AD-A054216; USAEHA-51-0875-78) Avail: NTIS HC A02/MF A01 CSCL 06/6

A hazard evaluation of candidate insect repellent AI3-36331 was performed by means of laboratory studies using rats, rabbits and guinea pigs. The technical grade compound caused mild skin irritation, but no eye irritation in rabbits, no sensitization reactions in guinea pigs, and did not demonstrate an acute ingestion hazard. GRA

N78-29742# Oak Ridge National Lab., Tenn.
HIGH RESOLUTION ULTRASONIC SCANNING OF ANIMAL AND HUMAN TISSUE IN-VIVO Ph.D. Thesis - Rensselaer Polytechnic Inst.
R. L. Roswell, R. E. Goans, and J. H. Cantrell, Jr. Aug. 1977 93 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5934) Avail: NTIS HC A05/MF A01

Burns impose one of the most serious injuries to the skin due to the organ's function within the body system and to the body as a whole. In an effort to better deal with the burn wound by the immediate excision and grafting of third degree burns, a high resolution ultrasonic pulse-echo technique was developed for determining burn depth. The experimental subjects were Yorkshire pigs because of the histological similarity between human and porcine skin. Burn depths were readily identifiable immediately postburn with the ultrasonic techniques, as were general trends concerning the burn-viable and viable-fat interfaces. The tissue characteristics, density and acoustic attenuation, effecting the impedance mismatch at the burn-viable tissue interface were investigated. The methods of fluid displacements and specific gravities yielded density values, while spectrum analyses produced attenuation measurements for normal, viable and burned tissue samples. ERA

N78-29743# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
THE IMPORTANCE OF THE MYOCARDIAL DEPRESSANT FACTOR (MDF) FOR THE OCCURRENCE OF IRREVERSIBLE SHOCK. A LITERATURE STUDY
C. vanderMeer Oct. 1977 26 p refs In DUTCH; ENGLISH summary
(MBL-1977-5; TDCK-69911) Avail: NTIS HC A03/MF A01

A literature survey on the patho-physiological importance of Myocardial Depressant Factor (MDF) in shock is presented. A critical evaluation of the data collected by Lefer, Glenn and collaborators anp the conclusions concerning the importance of MDF drawn by these authors from their experiments was made. It is concluded that the importance of MDF as a causative factor in irreversible shock, must for the time being be considered as very doubtful. Author (ESA)

N78-29744# Research Inst. of National Defence, Sundbyberg (Sweden).
TOXICOLOGICAL INVESTIGATION OF ZINC AND TITANIUM SMOKE COMPOSITIONS. A LITERATURE STUDY [TOXIKOLOGISK UNDERSOEKNING AV ZINK- OCH TITANROEKSATSER. EN LITTERATURSTUDIE]
Gunilla Heimburger Dec. 1977 25 p refs In SWEDISH
(FOA-C-40072-H2) Avail: NTIS HC A02/MF A01

The study concerned the elements contained in and produced by zinc and titanium smoke compositions. The primary products from zinc and titanium smoke compositions are ZnCl2 and TiCl4, respectively. These compounds are easily hydrolyzed by water. The limitation of the hydrolyze depends on air humidity. Highly corrosive chlorohydroxy zinc acids are primary products from ZnCl2 and they gradually turn into hydrochloric acid and zincoxy chloride. TiCl4 produces HCl and titanium oxides. No definite conclusions as to which smoke composition is least toxic can be drawn from available information. Author (ESA)

N78-29745# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF MICROWAVES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Elizabeth A. Harrison May 1978 228 p Supersedes NTIS/PS-77/0455; NTIS/PS-76/0387; NTIS/PS-75/384
(NTIS/PS-78/0432/1; NTIS/PS-77/0455; NTIS/PS-76/0387; NTIS/PS-75/384) Avail: NTIS HC $28.00/MF $28.00 CSCL 06R

This bibliography contains 212 abstracts. The biological effects on man and animals from exposure to microwaves are emphasized. In addition to dosages and tolerances, regulations, and standards are included. GRA

N78-29746# General Accounting Office, Washington, D. C. Community and Economics Development Div.
EFFORTS BY THE ENVIRONMENTAL PROTECTION AGENCY TO PROTECT THE PUBLIC FROM ENVIRONMENTAL NONIONIZING RADIATION EXPOSURES
23 Mar. 1978 16 p ref
(PB-279483/2; CED-78-79) Avail: NTIS HC A02/MF A01 CSCL 06R

The subject of nonionizing radiation has become a national concern because the population is receiving measurable exposures to the radiation. The health effects of such exposures even at low levels are controversial. Currently, there is no official U.S. environmental public health standard for exposure to nonionizing radiation sources, because U.S. Research programs have not yet developed sufficient data to establish standards for microwave and other nonionizing frequencies. The Environmental Protection Agency is responsible for eliminating or reducing potentially harmful health effects by limiting exposures from radiation sources. This report discusses Agency activities to (1) evaluate the need for protection standards, and (2) establish such standards where necessary. GRA

N78-29747# Nuclear Regulatory Commission, Washington, D. C. Office of Standards Development.
BEIRMOD, A COMPUTER PROGRAM FOR CALCULATING THE EFFECTS OF EXPOSURE TO IONIZING RADIATION
Charles A. Willis May 1978 33 p
(PB-279584/7; NUREG-0444) Avail: NTIS HC A03/MF A01 CSCL 06R

Use of the BEIRMOD (Biological Effects of Ionizing Radiation Models) computer program is described. The user may select (1) either the relative risk or the absolute risk model, (2) either 30 years or 'remainder of life' for the plateau duration for cancer other than leukemia, (3) the exposure period, and (4) the exposure rate. Output includes average life shortening (by radiation-induced cancer), percent of deaths caused by radiation, and average life span reduction per person-rem. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-29748 Japan Broadcasting Corp., Tokyo. Auditory and Visual Information Processing Research Group.
THE APPARENT RATE OF FLICKER
Tadahiko Fukuda Nov. 1977 9 p refs
(NHK-Labs-Note-219) Copyright. Avail: Issuing Activity

Attempts were made to measure the apparent rate of successive sinusoidal flicker and to investigate its relation to such parameters as stimulus size and retinal location by matching it with a second stimulus, an audio flutter. The auditory stimulus employed as a reference was a pure tone which was frequency modulated by a sine wave. It was observed that the apparent rate of flicker was not always equal to the actual rate. The apparent rate increased approximately in direct proportion to the frequency presented when target size was small and tended to be lower than the actual rate when target size was large. The apparent rate never exceeded approximately 10 Hz regardless of the presented flicker frequency or the luminance of the target. These tendencies were observed commonly in the fovea and in the periphery of the retina. J.A.M.

N78-29749# Arizona State Univ., Tempe. College of Education.
VERBAL PRESCRIPTIVE RULES IN COGNITIVE PRETRAINING FOR THE VERTICAL S-A TRAINING MANEUVER Interim Report
William V. Hagin, Robert C. Haywood, and Scott S. Herrington Jul. 1977 43 p refs
(Grant AF-AFOSR-2900-76)
(AD-A050971; TR-70615; AFOSR-78-0210TR) Avail: NTIS HC A03/MF A01 CSCL 05/9

A study was conducted to determine the effectiveness of verbal prescriptive rules in cognitive pretraining for an instrument flight maneuver. Thirty male pilot trainees participated in the study. Each subject had acquired simple aircraft control skills, but was naive with respect to the experimental maneuver. The subjects were assigned to one of three treatment groups. The first group received systematically-developed rule sets covering the entire maneuver. The second was given only the simple maneuver definition, but was asked to generate and record a set of rules for the maneuver. The third group was given only the maneuver definition. The effects of cognitive pretraining were assessed by having the subjects perform the maneuver in an instrument flight trainer immediately following pretraining. All three groups showed comparable achievement in learning the motor task. The results indicate that subjects who already know the component elements of a task do as well when given a simple definition of the maneuver and performance criteria as do subjects who are drilled on sets of rules for performance.
Author (GRA)

N78-29750# Air Training Command, Randolph AFB, Tex. Director of Operations Analysis.
ALTERNATIVES FOR FUTURE UNDERGRADUATE PILOT TRAINING
Steven G. Joseph Apr. 1977 268 p refs
(AD-A053374; Rept-77-1) Avail: NTIS HC A12/MF A01 CSCL 01/3

The Air Training Command was requested to develop and examine alternatives for replacement of the aging T-37 along with options which provide a more economically trained graduate. This study reports the results of that examination. Training requirements for UPT (Undergraduate Pilot Training) unchanged in the future, with the emphasis remaining on the acquisition of basic flying skills. A specialized pilot training system is required to effectively teach the 30 identified training requirements. Procurement of new aircraft is required to replace the T-37 and inaugurate specialized pilot training. T-38 fleet life can be extended ten years by conversion to a specialized UPT system. Acquisition and life cycle costs favor a three aircraft specialized UPT system; a primary aircraft replacement for the T-37, a new TTB (Tanker-Transport-Bomber) trainer, and use of the T-38 as a FAIR (Fighter-Attack-Interceptor-Reconnaissance) trainer. GRA

N78-29751# Research Inst. of National Defence, Stockholm (Sweden).
COMPARISON BETWEEN FLIGHT TEST DATA AND DATA FROM A THEORETICAL MODEL FOR THE DISCOVERY OF A GROUND TARGET FROM THE AIR [JAEMFOERELSE MELLAN DATA FRAAN ETT FLYGPROV OCH EN TEORETISK MODELL FOER UPPTAECKT AV MARKMAAL FRAAN LUFTEN]
Lars Persson and Henry Widen Aug. 1977 13 p refs In SWEDISH
(FOA-C-56010-H9/H6) Avail: NTIS HC A02/MF A01

Predictions made with a theoretical model for discovery and identification of ground targets from the air were compared with data from a flight test. Two different methods, the Q-method and the 1/5-method, were used to calculate the identifying function for two cases: case A implying low target contrast and infinite geometric visibility, case B high target contrast and 3 km geometric visibility. Results show that both methods could well predict the average identifying distance in case A. For case B this distance was overestimated by both methods. Distribution of the identifying distance was well predicted in both cases

with the Q-method but was underestimated with the 1/5-method. Author (ESA)

N78-29752# National Technical Information Service, Springfield, Va.
SIMULATORS IN EDUCATION AND TRAINING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Apr. 1977
Guy E. Habercom, Jr. Apr. 1978 167 p
(NTIS/PS-78/0378/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

This bibliography contains 162 abstracts of reports on simulators and simulation technology in a broad range of educational and training settings. Aerial, ground, marine and submarine operations are covered and several patents are included. Procedures are cited in many fields, such as radar, sonar, space shuttles, firefighting, management, sea navigation, computer aided systems, and lasers. GRA

N78-29753# National Technical Information Service, Springfield, Va.
SIMULATORS IN EDUCATION AND TRAINING, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, May 1977 - Mar. 1978
Guy E. Habercom, Jr. Apr. 1978 158 p Supersedes NTIS/PS-77/0035; NTIS/PS-76/0287
(NTIS/PS-78/0379/4; NTIS/PS-77/0335; NTIS/PS-76/0287) Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

This bibliography contains 153 abstracts. For abstract, see N78-29752. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-29754*# Science Applications, Inc., Englewood, Colo.
MAN-MACHINE INTERFACE ANALYSIS OF THE FLIGHT DESIGN SYSTEM
H. Rudy Ramsey, Michael E. Atwood, and John K. Willoughby 30 Jun. 1978 37 p
(Contract NAS9-15535)
(NASA-CR-151812; SAI-78-089-DEN) Avail: NTIS HC A03/MF A01 CSCL 05H

The objective of the current effort was to perform a broad analysis of the human factors issues involved in the design of the Flight Design System (FDS). The analysis was intended to include characteristics of the system itself, such as: (1) basic structure and functional capabilities of FDS; (2) user backgrounds, capabilities, and possible modes of use; (3) FDS interactive dialogue, problem solving aids; (4) system data management capabilities; and to include, as well, such system related matters as: (1) flight design team structure; (2) roles of technicians; (3) user training; and (4) methods of evaluating system performance. Wherever possible, specific recommendations are made. In other cases, the issues which seem most important are identified. In some cases, additional analyses or experiments which might provide resolution are suggested. G.Y.

N78-29755# Arizona State Univ., Tempe. Coll. of Education.
MEASURING PILOT PROFICIENCY ON AN INSTRUMENT TRAINING MANEUVER Interim Report
William V. Hagin, Scott S. Herrington, and Robert C. Haygood Aug. 1977 44 p refs
(Grant AF-AFOSR-2900-76)
(AD-A050972; TR-70820; AFOSR-78-0211TR) Avail: NTIS HC A03/MF A01 CSCL 05/9

The record/playback feature of modern, advanced digital simulators indicates a potential for the achievement of important methodological advances in observer training and in predetermining measurement reliability. An exploratory study recently completed showed that the record/playback feature of the Advanced Simulator for Pilot Training (ASPT) could be successfully used to facilitate the development and validation of a recording form for an instrument flight training maneuver. In addition, this feature was successfully used to train instructor pilot observers to reliably record maneuver performances using the form. These results have important research implications, since they will allow a degree of control over recording objectivity and reliability not previously possible. Researchers can be freed from after-the-fact correlational reliability estimations. In addition, innovative recording formats can be safely and efficiently developed and refined before validation in flight. Author (GRA)

N78-29756# Dynamics Research Corp., Wilmington, Mass.
INTEGRATION AND APPLICATION OF HUMAN RESOURCE TECHNOLOGIES IN WEAPON SYSTEM DESIGN Interim Report, Apr. - Oct. 1977
John C. Goclowski, William B. Askren (AF Human Resources Lab., Wright-Patterson AFB, Ohio), Gerard F. King, and Paul G. Ronco Mar. 1978 73 p refs
(Contract F33615-77-C-0016; AF Proj. 1959)
(AD-A053681; AFHRL-TR-78-6(2)) Avail: NTIS HC A04/MF A01 CSCL 05/5

The four basic activities of the coordinated human resource technology are described. The first is the consolidated data base development which processes source data. The second is the integrated requirements and task analysis (IRTA) which determines human resource requirements. The third is ISD/JGD product development. The fourth is the impact analysis which provides human resource and cost data on any specific configuration or alternative. It is through this activity that CHRT may influence the selection of design, maintenance operations and support alternatives. GRA

N78-29757# Dynamics Research Corp., Wilmington, Mass.
INTEGRATION AND APPLICATION OF HUMAN RESOURCE TECHNOLOGIES IN WEAPON SYSTEM DESIGN: COORDINATION OF FIVE HUMAN RESOURCE TECHNOLOGIES Interim Report, Apr. - Oct. 1977
John C. Goclowski, Gerard F. King, Paul G. Ronco, and William B. Askren (Advanced Systems Div., Wright-Patterson AFB, Ohio) Mar. 1978 73 p refs
(Contract F33615-77-C-0016)
(AD-A053680; AFHRL-TR-78-6(1)) Avail: NTIS HC A04/MF A01 CSCL 05/5

The five human resource technologies are defined as: maintenance manpower modeling (MMM), instructional system development (ISD), job guide development (JGD), system ownership costing (SOC), and human resources in design trade-offs (HRDT). The interrelationships among the five human resource technologies are identified and a methodology to apply them throughout weapon system acquisition is developed. The methodology, the coordinated human resource technology (CHRT), when applied, quantifies the reliability, maintainability, manpower, training, and job guide documentation requirements for a weapon system and allows these factors to influence design, maintenance, operations, and support concepts early in acquisition. CHRT also provides a means to estimate ownership cost. GRA

N78-29758# Queensborough Community College, Bayside, N. Y.
A MULTIPARAMETER TIME DOMAIN AVERAGING MODEL OF THE HUMAN OPERATOR Final Report, 1 Jun. - 30 Sep. 1977
Nathan Chao 1 Feb. 1978 48 p refs
(Grant AF-AFOSR-3350-77)
(AD-A054676; AFOSR-78-0625TR) Avail: NTIS HC A03/MF A01 CSCL 05/9

A time domain averaging model of the human operator was applied to model the operator's output for three different subjects, each of whom performed compensatory tracking tasks with three different types of plants. Model parameters were optimally extracted from each single run. The correlation obtained between the model and each run was about 0.9 in all cases. In the time domain parameter extraction process, each operator's control strategy and control characteristic were found and were discussed. Author (GRA)

N78-29759# Monosolar, Inc., Santa Monica, Calif.
IMPROVED SEMICONDUCTORS FOR PHOTOVOLTAIC SOLAR CELLS Quarterly Report, 15 Jul. - 31 Oct. 1977

30 Nov. 1977 18 p refs
(DSE/2457-5; QR-5) Avail: NTIS HC A02/MF A01

Electroplating doped cadmium telluride homojunctions on ITO-coated glass substrates using aqueous electrolytes at a temperature of 90 C is described. Latest cells made 90 C display very encouraging values of V/sub oc/ = 0.5 volts showing good junction formation. However J/sub sc/ is still low around 9 ma/sq cm and fill factor continues to measure 0.25 to 0.3, both indicating a continuing problem either with high series resistance in the layers or at the rear contact made to the p-type layer with silver or both. ERA

N78-29760# Los Alamos Scientific Lab., N. Mex.
RESPIRATOR STUDIES FOR THE NUCLEAR REGULATORY COMMISSION. PROTECTION FACTORS FOR SUPPLIED-AIR RESPIRATORS Progress Report, 1 Oct. 1976 - 30 Sep. 1977
Alan Hack, O. D. Bradley, and Andres Trujillo Dec. 1977 35 p refs
(Contract W-7405-eng-36)
(LA-7098-PR) Avail: NTIS HC A03/MF A01

The protection factors (efficiency) provided by 25 NIOSH approved supplied-air respirators were determined while the devices were worn by a panel of anthropometrically selected test subjects. The major recommendation was that demand-type respirators should neither be used nor approved. ERA

N78-29761# Research Inst. of National Defence, Stockholm (Sweden).
MEDICAL EVALUATION OF 2-PRESSURE SUIT USED IN EXPLOSIVE DECOMPRESSIONS UP TO 20.000 m ALTITUDE [MEDICINSK VAERDERING AV 2-TRYCKSDRAEKT ANVAEND VID EXPLOSIVA DEKOMPRESSIONER UPP TILL 20.000 m HOEJD]
Ulf Balldin Sep. 1977 17 p refs In SWEDISH
(FOA-A-59002-H3) Avail: NTIS HC A02/MF A01

The so-called two-pressure suit developed in Sweden for rescue at high altitude flight was tested from various medical safety aspects. The suit permits sufficient oxygen supply at high altitude up to 70 mm Hg (9.3 kPa) overpressure respiration through counterpressure against the thorax and through a pressure 3.2 times higher in the g-trousers. Ten test persons were exposed to explosive decompressions from 9,000 to 17,500 m or to 20,000 in 0.5 sec after 1 hr oxygen respiration in a low pressure chamber. No symptoms of decompression sickness or lung bursting with gas emboli to the central nerve system were observed. Lung X-ray after the test did in no case show bursting of the lung with gas leakage from the lungs to the pleural sack, pericardium, mediastinum, or the skin. Only in one case spurious intercardial gas bubbles (so-called silent bubbles in the blood circulation) were ascertained with Doppler ultrasound in one of the test persons after explosive decompression to 20,000 m altitude. Author (ESA)

N78-29762# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
PILOT WORKLOAD ANALYSIS BASED UPON IN-FLIGHT PHYSIOLOGICAL MEASUREMENTS AND TASK ANALYSIS METHODS
J. Smit 3 Jan. 1978 9 p refs Presented at the Intern. Symp. on Monitoring Behavior and Supervisory Control, Berchtesgaden, West Ger., 2 Mar. 1976
(NLR-MP-76001-U) Avail: NTIS HC A02/MF A01

An experimental program aimed at the analysis of pilot workload during low-level attack missions is described. In-flight physiological measures, subjective ratings, and performance measures were used to estimate the demand of the penetration and weapon delivery tasks. Two self appraisal scales were administered to assess the relationship between individual physiological reaction patterns and some personality traits. Author (ESA)

N78-29763# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
HUMAN CONTROL AND MONITORING-MODELS AND EXPERIMENTS
P. H. Wewerinke 3 Jan. 1978 27 p refs Presented at the 12th Ann. Conf. on Manual Control, Urbana Champaign, USA, 25-27 May 1976
(NLR-MP-76015-U) Avail: NTIS HC A03/MF A01

The results of a theoretical and experimental program concerning human monitoring behavior are discussed. Apart from monitoring an automatic approach combined monitoring and manual flight director control was studied to determine the interference between subtasks. Simultaneous monitoring and auditory tracking was also included. The results demonstrate that the multivariable monitor model adequately describes human behavior in the tasks. A multivariable workload model was developed which agrees excellently with subjective ratings. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-29764 Alabama Univ., University.
INTERACTIVE COMPUTER METHODS FOR CALCULATING GEOMETRICAL AND INERTIAL PROPERTIES OF GENERAL SHAPED AREAS AND VOLUMES OF REVOLUTION Ph.D. Thesis
Donna Sanders Farrior 1977 267 p
Avail: Univ. Microfilms Order No. 7809854

Methods for representation of a plane boundary curve are developed. One method uses spline interpolation with an extension for sharply turning corners. The other method is developed from an exact representation of the boundary by straight line segments and circular arcs. Green's Theorem is used to transform the various area integrals representing the geometrical and inertial properties into line integrals. Integrals for straight line segments are evaluated exactly and those for circular arcs are obtained numerically by use of a composite Gauss integration rule. Two computer programs, INERTSPL and GAIP, implementing these ideas are given. Requirements are established for a versatile computer aided design system incorporating the above numerical techniques. Such a system, called GAIP2, featuring a large user data base, graphics displays, and a flexible command language is developed. Dissert. Abstr.

N78-29765 Utah Univ., Salt Lake City.
OBJECT MODELS FOR COMPUTER AIDED DESIGN Ph.D. Thesis
Russell Jay Athay 1978 253 p
Avail: Univ. Microfilms Order No. 7811013

An underlying modeling system to support applications in computer aided design and scientific modeling was developed. Particular emphasis was given to two key issues: (1) data base support and (2), graphic interaction. The modeling system

which was designed and implemented partitions the data base into discrete objects. It is clained that this partitioning of the model into objects provides not only efficiency, but also clarity and flexibility. A graphic support system for designing complex three dimensional objects was implemented in the context of object models. The ideas discussed were implemented as actual working systems. These systems were used as the basis for an extensive mine engineering application and some preliminary work in the modeling of complex protein molecules. Dissert. Abstr.

N78-29766 Illinois Univ. at Urbana-Champaign, Urbana.
WALSHSTORE: THE APPLICATION OF BURST PROCESSING TO FAIL-SOFT STORAGE SYSTEMS USING WALSH TRANSFORMS Ph.D. Thesis
Ehud Bracha 1978 75 p
Avail: Univ. Microfilms Order No. 7811212

WALSHSTORE is concerned with the investigation into the application of orthogonal transforms, e.g., Walsh transforms, to the storage of visual images in a fail-soft manner, i.e., the system can sustain losses but the retrieved image can still be recognized, even if in a degraded form. The application of Burst Processing to various parts in such a system is investigated together with an analysis of the amount of storage and speed of computation that can be achieved. This paper presents the necessary theory and the implementation of the Walsh transformers and the fail-soft storage which were constructed and tested. Additionally, some software simulation results are compared to the actual machine performance. Dissert. Abstr.

N78-29767 North Carolina Univ. at Chapel Hill.
A METHODOLOGY FOR THE ERGONOMIC DESIGN OF INTERACTIVE COMPUTER GRAPHIC SYSTEMS, AND ITS APPLICATION TO CRYSTALLOGRAPHY Ph.D. Thesis
Edward Glen Britton 1977 462 p
Avail: Univ. Microfilms Order No. 7810424

Human factor principles, based on linguistics and psychological considerations are proposed for use in the ergonomic designing the features of an interactive computer graphics system. Successful use of the system in determining the structures of macromolecules and in crystallography is reported. Dissert. Abstr.

N78-29768 Wisconsin Univ. - Madison.
A TEST OF A COGNITIVE MODEL OF COMPUTER PROGRAM READABILITY Ph.D. Thesis
Dennis Carl Bunde 1978 242 p
Avail: Univ. Microfilms Order No. 7806411

The informal assertions which describe a computer program's operation must be understood if the communicability of programs written with different constructs are to be compared. By viewing program reading as a problem solving task, it is possible to predict that programs which overload human information processing are harder to read than those which do not. A human problem solving model is evaluated and applied to program readability. Applications for understanding program writing, debugging, and other tasks important to programmers are discussed. Dissert. Abstr.

N78-29769 Illinois Univ. at Urbana-Champaign, Urbana.
FURTHER RESULTS REGARDING MULTIPROCESSOR SYSTEMS Ph.D. Thesis
Donald Yi-chung Chang 1978 240 p
Avail: Univ. Microfilms Order No. 7811220

A brief description of multiprocessor systems in both hardware and software is given. Each system has a different architecture and its own advantages and disadvantages. They provide many examples of system design. However, a lot of questions arise in this area which are yet to be solved. This thesis tries to answer these questions in order to get a better understanding of multiprocessor system design. Simulation techniques is used to collect the data needed to answer the questions. A detailed description of the simulator and simulation results are given. Some logic design problems concerning the real system design are also discussed. Dissert. Abstr.

N78-29770 Illinois Univ. at Chicago Circle, Chicago.
OPTIMIZATION TECHNIQUES IN DESIGNING RELATIONAL DATABASE SYSTEMS Ph.D. Thesis
Wu-Haung Cheng 1978 224 p
Avail: Univ. Microfilms Order No. 7811085

An algebraic minimal cover algorithm is presented, which can be easily performed manually as well as automatically. Also, techniques for constructing a well formed integrated set of user views are presented, which is for designing an integrated database for all users. Techniques for constructing a decomposition tree are presented. And, a dynamic programming model is presented for finding a nearly optimal subset of a decomposition tree. Queued evaluation nets are presented, which are to hold incomplete updating commands from various users on shared information so that every user still sees what he should see or expect to see. Some miscellaneous aspects of logical database syntheses are also studied. They are: (1) weighting function. Dissert. Abstr.

N78-29771 Wisconsin Univ. - Madison.
A DESIGN FOR MACHINE LEARNING DURING CONTINUOUS INTERACTION WITH A SIMULATED ENVIRONMENT Ph.D. Thesis
Robert K. Korn 1978 225 p
Avail: Univ. Microfilms Order No. 7806432

A program was written and is being tested in a nontrivial simulated environment. The basic mechanisms are extremely general with respect to the nature of the environment, motor abilities, and senses, while fully utilizing known sensory characteristics. Behavior can be directed toward deferred as well as immediate reward and expected reward duration is taken into account. Compounding is used to develop learned hierarchical sensory and motor structures which permit progressively more advanced behavior without combinatorial increases in learning time. Dissert. Abstr.

N78-29772 Cornell Univ., Ithaca, N. Y.
STUDIES ON CLUSTERED FILES Ph.D. Thesis
Yin Chun Anita Wong 1978 123 p
Avail: Univ. Microfilms Order No. 7809533

Certain aspects of the clustered file organization are studied in this thesis. Specifically, comparisons are made between various vector matching functions used in an information search, including the cosine correlation function and the probabilistic correlation function. The probabilistic correlation function is examined and a modified function is proposed. The problem of term independence between clusters and within a cluster is investigated. Centroid vectors are modified to minimize the error incurred by using the probabilistic correlation function when the term independence assumption is false. Dissert. Abstr.

N78-29773# Inco, Inc., McLean, Va.
TRANSPARENT INTEGRATED INTELLIGENCE NETWORK: RESPONSE NORMALIZATION Final Technical Report, 15 Dec. 1976 - 14 Dec. 1977
Paul Stygar Griffiss AFB, N.Y. RADC Apr. 1978 115 p refs
(Contract F30602-77-C-0030; AF Proj. 4594)
(AD-A054308; INCO/1088-1277-TR-55-D(F); RADC-TR-78-74) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report presents preliminary specifications for a subsystem to normalize the query report formats received from heterogeneous DBMS in a Transparent Integrated Intelligence Network (TIIN). Author (GRA)

N78-29774# University of Southern Calif., Marina del Rey. Information Sciences Inst.
HP/MME TERMINAL: APPLICATION SPECIFICATION Technical Manual
Don Oestreicher, Paul Raveling, and Rob Stotz Mar. 1978 45 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A054722; ISI/TM-78-10) Avail: NTIS HC A03/MF A01 CSCL 09/2

This document describes the black box characteristics of the modified HP2649A terminal that ISI has developed for the Military Message Experiment (HP/MME). The communication interface between the terminal and the host computer is described, both in terms of the syntax and the semantics. The communication line discipline (protocol) is also described. Author (GRA)

N78-29775# Naval Research Lab., Washington, D. C. Communication Systems Div.

AN EXPERIMENT IN DATABASE ACCESS CONTROL Interim Report

Frank A. Manola and David K. Hsiao (Ohio State Univ.) 16 Mar. 1978 38 p refs Presented at 1st Intern. Conf. on Computer Software and Appl., Chicago, 8-11 Nov. 1977

(RF21211401)

(AD-A054189; NRL-8176) Avail: NTIS HC A03/MF A01 CSCL 09/2

To prevent unauthorized access to sensitive information, contemporary data-management systems may require redundant hardware, software, and data. In a military environment, where information is classified and users must have specific access clearances, the lack of automated enforcement of administrative control and the tendency toward overclassification can further increase hardware, software, and data requirements. A naval database was created for an experimental data-secure system to show that the system's advanced features can help solve real-world access-control problems and eliminate related hardware, software and data redundancy. Typical scenarios which characterize multilevel access-control requirements in a real military environment were devised and tested on the system. The experience from demonstration of the system relates to the general area of access control in database-management systems.

Author (GRA)

N78-29776# Harris Corp., Melbourne, Fla. Electronic Systems Div.

INTELLIGENCE SECURITY SUBSYSTEM Final Technical Report, Oct. 1976 - Oct. 1977

F. Anders, W. Mall, R. McGill, J. McLaughlin, and B. Thompson Mar. 1978 324 p refs

(Contract F30602-76-C-0445)

(AD-A054508; RADC-TR-78-33) Avail: NTIS HC A14/MF A01 CSCL 09/2

The report finds that it is technically feasible to achieve security in computer systems and specifies an engineering model that would confirm the findings. Author (GRA)

N78-29777# Los Alamos Scientific Lab., N. Mex.

FIBER OPTICS AND MICROPROCESSORS: A CONTROL-SYSTEM SOLUTION FOR THE LASER-FUSION ENVIRONMENT

Michael E. Thuot 1978 17 p refs Presented at the NEPCON/WEST Conf., Anaheim, Calif., 28 Feb. - 2 Mar. 1978

(Contract W-7405-eng-36)

(LA-UR-78-329; Conf-780219-1) Avail: NTIS HC A02/MF A01

The use of fiber optics and microprocessors in a distributed computer control system for a 100 kJ CO2 laser fusion facility is described. Gas laser control systems must operate in an environment in which megavolt Marx circuits generate megampere discharges in the laser amplifiers, with attendant high electromagnetic fields. By linking the distributed controls with fiber optics the adverse effect of these fields on the hard wired controls was minimized, and the additional advantage of ground isolation gained. Fiber optic subsystems and interfaces include low error rate, digital communication links between computers; nanosecond timing and trigger links; fiber optic parameter monitors with dc-to-10 MHz bandwidths; binary fiber optic power control for valves, motors, and contactors; and binary fiber optic status interfaces to monitor the system response to control outputs.

ERA

N78-29778# Los Alamos Scientific Lab., N. Mex.

COMPUTER ASSISTED COST ESTIMATING AT LOS ALAMOS SCIENTIFIC LABORATORY

James E. Spooner and Roger A. Stutz 1977 10 p ref Presented at the AESOP ERDA Contractor Symp. on Computers, Boston, 14 Sep. 1977

(Contract W-7405-eng-36)

(LA-UR-77-2070; Conf-770937-2) Avail: NTIS HC A02/MF A01

Compared to a manual system, an improvement in production time of the original estimate and a significant improvement in response time to subsequent alternates was expected. In addition, the impact of design and scope changes throughout the life of the project will be recorded against a detailed, rather than gross model of the project. LACCE is a 33,000 line FORTRAN code and operates interactively on our CDC 6600 under NOS and incorporates two on-line data bases for system assemblies, as well as construction tasks. Off-line data bases were maintained for periodic updates of the on-line system. Total disk storage for on-line data bases was the order of several million bytes. Delivery of the prototype was scheduled for the end of August of this year with the data bases shortly thereafter. ERA

N78-29779# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

THE MICROPROCESSOR INTEL 8080 A AND ITS USE AS DIGITAL FILTER [DER MIKROPROZESSOR INTEL 8080 A UND SEIN EINSATZ ALS DIGITALES FILTER]

Kurt H. Moser and Joerg Schott 29 Nov. 1977 48 p In GERMAN Report will also be announced as translation (ESA-TT-484)

(DLR-IB-552-77/22) Avail: NTIS HC A03/MF A01

The structure of the INTEL 8080 microprocessor and particularly the properties of the calculation module SBC 80/10 and of the 80/10 system is discussed. The construction of a digital filter for data recovery (extrapolation filter) in software and hardware is described. ESA

N78-29780# Department of Agriculture, Washington, D.C. Systems Engineering Branch.

DIRECT ACCESS DATA MIGRATION SYSTEM

Max R. Miller Mar. 1978 22 p refs

(PB-280074/6; USDA-DF-78-016) Avail: NTIS HC A02/MF A01 CSCL 09B

This system is used to move unused data sets from direct access to tape. Migrated data sets are stacked onto tapes, approximately 250 to 300 each tape. A retrieval function is included through which users can retrieve migrated data sets back to direct access. The Migration System is dependent on the Archive Master File from the Disk Inventory System. GRA

N78-29781# Department of Agriculture, Washington, D.C. Systems Engineering Branch.

DISK INVENTORY SYSTEM

Max R. Miller Mar. 1978 13 p

(PB-280068/8; USDA-DF-78-015a) Avail: NTIS HC A02/MF A01 CSCL 09B

A system used to inventory all on-line direct access volumes and through it provide users and Center management with vital information on direct access data sets, volumes, and space utilization is described. The system is slightly dependent on Agriculture's project number environment for billing and authorization, but is easily modifiable. GRA

N78-29782# Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.

DEVELOPMENT OF A LABORATORY DATA SYSTEM EXECUTIVE SUMMARY Progress Report, 1972 - 1978

Mar. 1978 16 p Sponsored by DOT

(PB-279765/2; FHWA/CT/RD-360-S-78-4) Avail: NTIS HC A02/MF A01 CSCL 09B

A computer system was designed to simplify and streamline the flow of data both within and outside of a materials testing laboratory handling up to 75,000 tests annually. Statistical programs facilitated assignment of inspection personnel and provided justification for reduced, and in some cases, increased frequency of testing on many items. GRA

N78-29783# General Accounting Office, Washington, D. C. Financial and General Management Studies Div.

SHIFTING THE GOVERNMENT'S AUTOMATIC DATA PROCESSING REQUIREMENTS TO THE PRIVATE SECTOR: FURTHER STUDY AND BETTER GUIDANCE NEEDED

11 Apr. 1978 39 p

(PB-279482/4; FGMSD-78-22) Avail: NTIS HC A03/MF A01 CSCL 09B

A General Accounting Office nationwide survey of the automatic data processing services industry showed that many firms were limited in their near term ability to meet significant quantities of Federal agencies' large scale data processing requirements. Careful consideration of the industry's present and

future capabilities by the Office of Federal Procurement Policy within the Office of Management and Budget would be useful in revising proposed guidelines to help Federal agencies obtain more of their automatic data processing from commercial sources. GRA

N78-29784# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
MANAGEMENT OF DATA ELEMENTS IN INFORMATION PROCESSING Final Report
Hazel E. McEwen, ed. Apr. 1978 155 p refs Proceedings of the 3rd Natl. Symp. held at NBS, Gaithersburg, Md., 28-30 Sep. 1977
(PB-279661/3; NBSIR-78-1446) Avail: NTIS HC A08/MF A01 CSCL 09B

Data element management in the field of health care, energy, paperwork management, trade data standards, and museum data is discussed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-29785 Iowa Univ., Iowa City.
FUNCTION SCHEMATA Ph.D. Thesis
Adrienne Rendery Critcher 1977 191 p
Avail: Univ. Microfilms Order No. 7810337

The parameter passage mechanisms considered are: (1) call by value, (2) call by copy, (3) call by value/result, (4) call by reference, and (5) call by name. These mechanisms are compared in power within categories of actual parameter types. The following combinations of parameter passage mechanisms are also considered: (1) call by value and reference, (2) call by copy and reference, (3) call by name and value, (4) call by name, value/result, and value, and (5) call by name, reference, and value, which are based on the combinations appearing in, respectively, PL/1, FORTRAN, ALGOL 60, ALGOL W, and EULER. Various relationships are established and, in particular, EULER is shown to contain the most powerful combination. The index equality test in schemes is found to add power to defined function schemes but does not enable any relationships to be established among the parameter passage mechanisms when arrays and array cells are allowed as actual parameters. Dissert. Abstr.

N78-29786 Wisconsin Univ. - Madison.
AUTOMATIC DIFFERENTIATION OF COMPUTER PROGRAMS AND A POSTERIORI ERROR BOUNDS FOR TWO-POINT BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Gershon Kedem 1978 115 p
Avail: Univ. Microfilms Order No. 78-06431

A method for the automatic differentiation of computer functions (subroutines) written in a high level language is discussed. A theory is developed to show that most functions that arise in application can be differentiated automatically. Implementation of two types of differentiation is described. Considering a general two-point boundary value problem, it is shown how the error made in the numerical solution can be bound a posteriori. Numerical schemes are developed for a case where a certain function is a polynomial. Examples are given of computational existence proofs for problems where analytical existence proofs are not known. Dissert. Abstr.

N78-29787 Illinois Univ. at Urbana-Champaign, Urbana.
ANALYZING THE LEARNING OF COMPUTER PROGRAMMING CONCEPTS THROUGH THE TEACHING OF PAL Ph.D. Thesis
Hanna Kammerahl Kruczek 1978 143 p
Avail: Univ. Microfilms Order No. 7811259

To find the best way of teaching programming to children, the process by which programming is learned should be analyzed; however little has been done to study the process PAL (Picture Algorithm Language), a programming language designed for very young children, which was used as a means of studying this process is described. Tests in which several children learn to write computer programs are detailed. Also included are observations from these tests as to which concepts are easy and which are difficult to learn. Finally, some suggestions are made for teaching children how to program. Dissert. Abstr.

N78-29788 Cornell Univ., Ithaca, N. Y.
SUCCINCTNESS OF DESCRIPTIONS OF CONTEXT-FREE, REGULAR AND FINITE LANGUAGES Ph.D. Thesis
Erik Meineche Schmidt 1978 90 p
Avail: Univ. Microfilms Order No. 78-09516

The descriptional power of finite automata, regular expressions, pushdown automata and certain generalized models of macro grammars. Descriptional power is measured in essentially two different ways. In the first the results are relative in the sense that the power of one class of automata or grammars is measured relative to that of another class. The emphasis in this area is on ambiguity in finite automata and pushdown automata. The other measuring method uses complexity theory, in particular the notion of a set being hard for a complexity class. The elements of a very hard set are considered very succinct encodings of instances of some problem. Finally ambiguity in regular expressions is considered. Dissert. Abstr.

N78-29789 Carnegie-Mellon Univ., Pittsburgh, Pa.
WORD HYPOTHESIZATION FOR LARGE-VOCABULARY SPEECH UNDERSTANDING SYSTEMS Ph.D. Thesis
Allen Richard Smith, Jr. 1978 149 p
Avail: Univ. Microfilms Order No. 78-11505

Research directed toward the development of general English speech understanding systems is described. The relatively unconstrained grammars are large vocabularies characterizing such systems require them to eliminate most of the words found in their vocabularies by using only acoustic information. In particular, the design and performance of a bottom-up word hypothesizer capable of handling large vocabularies (10,000 words) are presented which takes segmented and labeled speech as input and produces word hypotheses. The primary concerns of the thesis are the problems involved with large vocabularies and the effect of large vocabularies on word hypothesization. Dissert. Abstr.

N78-29790# Research Inst. of National Defence, Stockholm (Sweden).
EFFICIENT MATRIX TRANSPOSITION WITH LIMITED HIGH SPEED STORAGE
Jan-Olof Eklundh 1978 21 p refs *Its* FOA Reports, Vol. 12, No. 1, 1978
(Grant AF-AFOSR-3271-77)
(FOA-B-30021-E1; ISBN-91-7056-050-1) Avail: NTIS HC A02/MF A01

The problem of transposing externally stored matrices is discussed. The performance of the basic algorithms as a function of the matrix dimensions is evaluated, and possible implementations are discussed. A general scheme for determining an almost optimal strategy is outlined for an algorithm. Several examples are given. J.M.S.

N78-29791*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
MODIFICATIONS TO THE ACCURACY ASSESSMENT ANALYSIS ROUTINE SPATL TO PRODUCE AN OUTPUT FILE
J. G. Carnes Jun. 1978 36 p
(Contract NAS9-15200)
(NASA-CR-151810; LEC-12175) Avail: NTIS HC A03/MF A01 CSCL 09B

The SPATL is an analysis program in the Accuracy Assessment Software System which makes comparisons between ground truth information and dot labeling for an individual segment. In order to facilitate the aggregation of this information, SPATL was modified to produce a disk output file containing the necessary information about each segment. L.S.

N78-29792# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UPDATING THE INPUT-OUTPUT MATRIX USING MATHEMATICAL METHODS

Joanilio Rodolpho Teixeira and Derli Chaves Machado DaSilva Jul. 1977 32 p refs In PORTUGESE; ENGLISH summary Submitted for publication
(INPE-1055-PE/062) Avail: NTIS HC A03/MF A01

Problems associated with the updating of Leontief type input/output matrices are examined. Updating techniques such as the RAS method, linear and quadratic programming are discussed. Mathematical, statistical, and computational interpretation of the results are given. The various approaches are compared and their potential is critically evaluated. J.M.S.

N78-29793# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN XPL/ALGOL TRANSLATOR M.S. Thesis [UM TRADUTOR XPL/ALGOL]
Icaro daSilvaMartins Jul. 1978 435 p refs In PORTUGUESE; ENGLISH summary
(INPE-1304-TPT/096) Avail: NTIS HC A19/MF A01

A translator from XPL into ALGOL-B6700, version 11.5, using the mixed strategy precedence parsing method is presented. Its main subproduct is that it makes possible the implementation, in B6700 systems, of the compiler generator. Author

N78-29794*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
MODIFICATIONS TO THE ACCURACY ASSESSMENT ANALYSIS ROUTINE MLTCRP TO PRODUCE AN OUTPUT FILE
J. G. Carnes Jun. 1978 77 p
(Contract NAS9-15200)
(NASA-CR-151811; LEC-12176) Avail: NTIS HC A05/MF A01 CSCL 09B

Modifications are described that were made to the analysis program MLTCRP in the accuracy assessment software system to produce a disk output file. The output files produced by this modified program are used to aggregate data for regions greater than a single segment. G.G.

N78-29795# Maryland Univ., College Park. Dept. of Computer Science.
A COMPARISON OF THE AXIOMATIC AND FUNCTIONAL MODELS OF STRUCTURED PROGRAMMING Interim Report
Victor R. Basil and Robert E. Noonan (College of William and Mary) Feb. 1978 44 p refs
(Contract AF-AFOSR-3181-77)
(AD-A053629; TR-630; AFOSR-78-0737TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper discusses the axiomatic and functional models of the semantics of structured programming. The models are presented together with their respective methodologies for proving program correctness and for deriving correct programs. Examples using these methodologies are given. Finally, the models are compared and contrasted. Author (GRA)

N78-29796# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ARPANET ROUTING ALGORITHM IMPROVEMENTS Semiannual Technical Report, 1 Oct. 1977 - 1 Apr. 1978
J. M. McQuillan, I. Richer, and E. C. Rosen Apr. 1978 199 p refs
(Contract MDA903-78-C-0129; ARPA Order 3491)
(AD-A053450; BBN-3803; SATR-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes progress during the first six months of a contract to make several improvements to ARPANET routing. Some principal conclusions are: Several problems have been discovered in the present congestion control, line up/down procedures, and loop suppression techniques through the use of a new real-time monitoring capability. Solutions to most of these problems have been developed; operational experience with these changes is presented. A new set of line up/down procedures with much better performance was developed and analyzed. Extensive measurements of network delay were carried out; delays fluctuate rapidly over a large range, making it difficult to devise effective estimation techniques. The present routing algorithm is itself a major contributor to network delay due to the computations and update messages it requires. A set of improvements was designed for the present routing algorithm to make it more efficient and effective. However, a new algorithm, based on performing the entire shortest path calculation at each node, incrementally for each network change, appears to be a better choice for installation in work change, appears to be a better choice for installation in the ARPANET. GRA

N78-29797# Stanford Univ., Calif.
DECOMPOSITION IN FIXED POINT COMPUTATION
Daniel Solow Dec. 1977 130 p refs
(Contracts DAAG29-74-C-0032; N00014-75-C-0865; EY-76-S-03-0326; Grant NSF MCS-76-20019; NSF MCS-77-05623; EPRI Proj. 652-1)
(AD-A053439; SU-SOL-77-32) Avail: NTIS HC A07/MF A01 CSCL 12/1

One result of this paper is the most efficient complementary pivot algorithm to date for handling the optimization problem. The second major contribution is a general structure on fixed point problems which, when present, enables one to work in a lower dimensional space. It is shown that the general constrained optimization problem may sometimes be formulated as a fixed point problem possessing this property. The basic approach adopted in this work for handling the general constrained optimization problem is to use an implicit function (derived from the equality constraints) to solve for some dependent variables in terms of the remaining independent ones. Under certain circumstances, a fixed point algorithm may be used to search for optimal values of the independent variables while Newton's method is used to determine values of the dependent variables. Theoretical conditions on the original functions are developed to guarantee that the fixed point algorithm converges to a solution and various techniques are devised to enhance the overall efficiency. GRA

N78-29798# Federal COBOL Compiler Testing Service, Washington, D. C.
SURVEY OF CONVERSION SUPPORT SOFTWARE
Paul Oliver 16 Mar. 1978 19 p
(AD-A053741; ECCTS/TR-78/02) Avail: NTIS HC A02/MF A01 CSCL 09/2

This survey of conversion support software was compiled to be used by the Federal COBOL Compiler Testing Service in its implementation of a Federal Conversion Support Center. It includes items which deal with portability as well as conversion, reflecting the compiler's belief that problem avoidance (developing portable software) is at least as important as problem solution (conversion), and that the two issues are closely related. Ergo the inclusion of programming aids such as higher-level language processors. No attempt has been made to date to evaluate each of these software tools - such an evaluation is best performed by the organization planning the use of these tools. Where available, a mailing address for a given company or source is included. Author (GRA)

N78-29799# Pattern Analysis and Recognition Corp., Rome, N. Y.
INTERACTIVE DIGITAL RECEIVER SIMULATOR (IDRS) SYSTEM USER'S MANUAL AND SOFTWARE DOCUMENTATION
Robert E. Bozek, Joseph C. Breda, Om P. Gupta, Roland H. Holman, Raymond J. Staron, and Dennis D. White Griffiss AFB, N. Y. RADC Mar. 1978 148 p refs
(Contract F30602-76-C-0126)
(AD-A053684; PAR-76-30; RADC-TR-78-44) Avail: NTIS HC A07/MF A01 CSCL 09/4

This report describes the design and implementation of the Interactive Digital Receiver Simulator (IDRS). The IDRS is a computer program that is capable of processing predetected signals that have been converted to digital format and recorded. It allows a user to computer interactively produce (1) desired hardcopy patterns of signals for a detailed analysis of modulation characteristics and (2) processed signal segments for processing by pattern analysis/recognition programs for feature extraction. In essence, the IDRS program provides the user with the capability of interactively creating a digital receiver to his specifications. Author (GRA)

N78-29800# General Electric Co., Schenectady, N. Y. Research and Development Center.

TIME-DOMAIN TWO-DIMENSIONAL COMPUTER SIMULATION OF THREE-TERMINAL SEMICONDUCTOR DEVICES Interim Report
S. P. Yu and W. Tantraporn 1977 11 p refs
(Contract F44620-76-C-0043; AF Proj. 2305)
(AD-A054287; AFOSR-78-0786TR) Avail: NTIS HC A02/MF A01 CSCL 09/1

Special schemes for treating device geometry permit the use of the very fast Fourier analysis technique for solving the two dimensional Poisson's equation so that the dynamics of three terminal semiconductor devices can be computer simulated economically. FET's and bipolar devices have been successfully simulated. Author (GRA)

N78-29801# School of Aerospace Medicine, Brooks AFB, Tex.
GENERAL STRIP CHART PLOTTING ROUTINE Final Report, 1 Jan. 1975 - 1 Jan. 1977
Paul A. Lozano Feb. 1978 19 p
(AF Proj. 6319)
(AD-A054156; SAM-TR-78-5) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes a subroutine plotting package with its calling sequences and arguments providing the technical information needed to write graphic computer programs in Fortran IV programming language. It presents several examples showing different applications. Author (GRA)

N78-29802# California Univ., Los Angeles. Western Management Science Inst.
AGGREGATION THEORY AND ITS APPLICATION TO MODELING IN MATHEMATICAL PROGRAMMING
Arthur M. Geoffrioni Dec. 1977 19 p refs
(Contract N00014-69-A-0200)
(AD-A054061; WMSI-Working-Paper-278) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper reviews the newly emerging theory of a priori error bounds for aggregation of mathematical programming models. The main technical building blocks are described in some detail, and the available applications are briefly reviewed. Author (GRA)

N78-29803# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
HDM: COMMAND AND STAFF OVERVIEW
Lawrence Robinson Feb. 1978 64 p refs
(Contract N00123-76-C-0195; SRI Proj. 4828)
(AD-A054482; SRI-CSL-49) Avail: NTIS HC A04/MF A01 CSCL 09/2

HDM (the SRI Hierarchical Development Methodology) is an integrated set of concepts, procedures, languages, and on-line tools intended to assist in all stages of the software-development process. This document provides a description of HDM that is suitable for project managers or higher-level executives who are contemplating the use of HDM on software projects that they manage. Author (GRA)

N78-29804# Los Alamos Scientific Lab., N. Mex.
RECENT DEVELOPMENT IN THE SESAME EQUATION-OF-STATE LIBRARY
B. I. Bennett, J. D. Johnson, G. I. Kerley, and G. T. Rood Feb. 1978 21 p refs
(Contract W-7405-eng-36)
(LA-7130) Avail: NTIS HC A02/MF A01

The Sesame Library is a computer file of tabular equations of state and other material properties, developed in Group T-4 of the Los Alamos Scientific Laboratory. A description is given of some of the theoretical models used in the library, the structure of the data storage and acquisition system, and the computer routines that were developed to access and use the tables in practical applications. It also discusses how non-LASL users can obtain the Sesame data and subroutine libraries. ERA

N78-29805# Pennsylvania State Univ., University Park.
GENERAL MULTI-CONFIGURATION HARTREE-FOCK PROGRAM: MCHF77
Charlotte Froese Fischer Nov. 1977 90 p
(Contract EG-77-S-02-4264)
(COO-4264-1; RT-225) Avail: NTIS HC A05/MF A01

A listing of a general program for multiconfiguration Hartree-Fock (MCHOF) calculations is presented including its documentation. Several examples are given showing how the program may be used. Typical output for several cases is also presented. The program was tested over an extended period of time for a large variety of cases, and is written for the IBM 360 or 370 in double precision arithmetic. ERA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-29806 California Univ., Los Angeles.
PEAK LOAD PRICING OF COMPUTER NETWORK SERVICES Ph.D. Thesis
Kweku Ewusi-Mensah 1978 138 p
Avail: Univ. Microfilms Order No. 78-11246

An economic model is developed for the peak-load pricing problem wherein different price schedules are used for local and nonlocal or remote users of the same service over different time periods. Each center is assumed to act independently to maximize a specified objective function. Three alternative objective functions relating to the sum of producer's and consumer's surplus, profit and revenue are considered with each objective function representing different management goals. Various pricing schemes under different operating conditions are presented which are applicable to networks consisting of computer centers with general production cost functions and user groups with demand functions dependent on the price at the center alone. Implementation of the results is discussed. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N78-29807 Illinois Univ. at Urbana-Champaign, Urbana.
SINGULAR PERTURBATION OF NONLINEAR REGULATORS AND SYSTEMS WITH OSCILLATORY MODES Ph.D. Thesis
Joe Hong Chow 1978 120 p
Avail: Univ. Microfilms Order No. 7811223

Singular perturbation techniques are applied to nonlinear optimal control problems and systems with high frequency oscillatory behavior. For a class of nonlinear regulator problems the Hamilton-Jacobi equation is solved as a power series expansion whose coefficients are solved from equations involving the slow variables only. Near-optimal feedback controls are obtained. Through the construction of a composite Lyapunov function, it is shown that these controls can stabilize large disturbances of the fast variables. A fixed endpoint nonlinear control problem is decomposed into three lower order problems, namely, the nonlinear reduced order problem and the linear quadratic left and right boundary layer problems. For systems with high frequency oscillatory behavior, the original system decomposed into a slowly varying system and a fast oscillatory system. Dissert. Abstr.

N78-29808 Minnesota Univ., Minneapolis.
LINEAR EQUIVALENCES IN HEREDITARY CONTROL SYSTEMS Ph.D. Thesis
Robert Franklin Stover 1977 172 p
Avail: Univ. Microfilms Order No. 78-10265

Methods for establishing linear equivalences between hereditary control systems were investigated along with the benefits of being able to transform hereditary control systems into certain standard or canonical forms. Certain of the ordinary canonical forms are extended to the hereditary case. Transformations to these standard forms from the general case are derived. Then several theorems are established to show the conditions under which these linear equivalences will exist. Since hereditary systems have initial functions as well as normal initial conditions

considerable attention is given to the effect of these complex transformations on this situation. Several specific techniques are developed to solve the problems arising from transformation of initial functions. Dissert. Abstr.

N78-29809 Missouri Univ., Columbia.
DECISION RULES AND DECISION TREE APPROACH IN PATTERN RECOGNITION THEORY Ph.D. Thesis
Chuk-Kwan Athene Choy 1977 436 p
Avail: Univ. Microfilms Order No. 78-03703

Three approaches for multiclass decision classification are examined. They are: (1) pair-wise Modified Maximum Likelihood Decision Rule (MMLDR) using measurement selection for each class-pair, (2) pair-wise binary decision tree classifier for continuous measurements and (3) step-wise classifier using binary decision trees. The maximum overall probability of correct was the criterion used in optimizing these trees. The results of these decision rules applied to several congenital disease data bases are listed, including the Congenital Heart Disease Segmented-Heart-Shape Data Base consisting of 541 cases in six classes. Dissert. Abstr.

N78-29810# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
THE COMPUTATION OF IMMEDIATE TEXTURE DISCRIMINATION
Bruce R. Schatz Aug. 1977 99 p refs
(Contract N00014-75-C-0643)
(AD-A053804; AI-M-426) Avail: NTIS HC A05/MF A01 CSCL 06/4

The computation of immediate texture discrimination involves finding boundaries between regions of differing texture. Various textures are examined to investigate the factors determining discrimination in the limited domain of line-and-point images. Two operators embodying necessary properties are proposed: length and orientation of actual lines and of local virtual lines between terminators. It is conjectured that these are sufficient as well. Relations between this theory and those of Julesz and of Marr are discussed. Supporting psychological evidence is introduced and an implementation strategy outlined. Author (GRA)

N78-29811# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
TOWARD A THEORY OF PROBABILISTIC AUTOMATA WITH ENVIRONMENTS Final Report
Jerren Gould (Claremont Graduate School, Calif.) and Edward J. Wegman 1978 9 p refs
(Contract N00014-67-A-0321-0006; Grant AF-AFOSR-2840-75; AF Proj. 2304; NR Proj. 042-269)
(AD-A053986; AFOSR-78-0730TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

The viewpoint is taken that every probabilistic automation is situated within a sequence of environments which affects the initial state distribution and the transition function. There exists a probabilistic automaton within a deterministic environment sequence (ADE) which defines an event which is not a PCE, yet in certain nontrivial cases the behavior of an ADE can be simulated by a probabilistic automaton. For probabilistic automata within random environment sequences there is a mean equivalent canonical representation which eliminates the randomness due to probabilistic transition. Author (GRA)

N78-29812# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
THE APPLICATION OF DIFFUSION APPROXIMATIONS TO THE STUDY OF TIME-SHARING COMPUTERS AND TRANSITORY QUEUEING SYSTEMS Final Report
John P. Lehoczky 1978 11 p
(Grant AF-AFOSR-2642-74; AF Proj. 2304)
(AD-A054313; AFOSR-78-0869TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research has been concentrated on two fundamental goals: the development of a new technique for analyzing stochastic systems, the diffusion approximation, and the application of diffusion approximations to the analysis of certain special stochastic models of Air Force interest. The specific models chosen for study were time-sharing computer systems, maintenance and repair systems, communication systems, and queueing networks in general. The research has shown that the technique of diffusion approximations provides an excellent tool for describing, analyzing, and optimizing stochastic models. It is especially important to note that the technique works well for very complex systems, systems which cannot be analyzed by ordinary methods. An entirely new approach has been developed for describing, analyzing and optimizing stochastic models. An entirely new approach has been developed for describing and possibly for optimizing the scheduling of time sharing computer systems with multiple job types. GRA

N78-29813# Research Inst. of National Defence, Stockholm (Sweden).
ANALYTIC METHOD FOR DIMENSIONING ABSOLUTE STABLE CONTROL SYSTEMS [ANALYTISK METOD FOER DIMENSIONERING AV ABSOLUTSTABILA REGLERSYSTEM]
Lennart Brandqvist Jul. 1977 33 p ref In SWEDISH
(FOA-C-20187-E4) Avail: NTIS HC A03/MF A01

A simple analytic method for stability analysis of control systems is treated. The method is based on an amplification factor Ko, critical to the stability. Introducing stabilizing filters and choosing some appropriate filter parameter alpha can make Ko disappear in certain cases. Stability no longer depends on the system's amplification factor K, which means that K can be chosen arbitrarily big. The system is then called absolutely stable. As an application example a general stability analysis was carried out, as well as fourth order integrating systems. The method was applied to a stabilized air robot and a target seeking air robot. The case of absolute stability of nonlinear control systems is considered. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-29814 Southern Methodist Univ., Dallas, Tex.
A NEW APPROACH TO ARMA MODELING Ph.D. Thesis
Donald Dean McIntire 1977 187 p
Avail: Univ. Microfilms Order No. 7809992

Currently an extremely popular model for forecasting future behavior of time series is the autoregressive-moving average (ARMA) model. Unfortunately, an adequate procedure for selecting the appropriate forecasting model was unavailable. Stemming from spectral density estimation studies a satisfactory approach to ARMA model identification is derived and presented in this dissertation. The overwhelming advantage of the technique discussed is its ability to simultaneously determine the orders of both the autoregressive and moving average operators. Based upon certain characteristics of the technique, a statistic is presented supplying the capability of automatic order selection. The model identification procedure is extended to the multiple time series problem as well as some interesting solutions to coefficient estimation. Dissert. Abstr.

N78-29815 Oklahoma State Univ., Stillwater.
A STUDY OF CORRELATION AMONG ERROR TERMS OF A REPEATED MEASURES DESIGN Ph.D. Thesis
Ralph Earl Merriman 1977 82 p
Avail: Univ. Microfilms Order No. 7811058

The two factor experiment with t levels of treatment factor A occurring on each of s sampling elements nested under each of r levels of a second factor B, as in a split plot experiment is considered. In the study, power comparisons involving the subunit mean square ratios are made between several methods of analysis frequently used to test the null hypothesis of no treatment A effect and of no treatment A by treatment B interaction, the comparisons being made over many cases involving different patterns of correlation among subunit errors. The power of the epsilon-adjusted test is compared with the power of the usual test, the test of hypothesis using the usual analysis. Dissert. Abstr.

N78-29816 Minnesota Univ., Minneapolis.
FOURIER-WIENER TRANSFORMS OF FUNCTIONALS OF ONE AND SEVERAL WIENER VARIABLES Ph.D. Thesis
Jerome Lehman Caldwell 1977 190 p
Avail: Univ. Microfilms Order No. 78-09635

The functionals considered are defined on real or complex Wiener space. The first functionals considered are those which are finite dimensional and square integrable. A translation formula for the Fourier-Wiener transform which is analogous to a translation formula for ordinary Fourier transforms is obtained. This formula is then used to solve a difference equation. The class of functionals on K, which are continuous in the Hilbert norm, entire in a certain sense, and of exponential type are considered. Three classes of functionals of several Wiener variables are also considered. Dissert. Abstr.

N78-29817 Massachusetts Univ., Amherst.
THE BOHL TRANSFORMATION AND OSCILLATION OF LINEAR DIFFERENTIAL SYSTEMS Ph.D. Thesis
Stuart Goff 1978 89 p
Avail: Univ. Microfilms Order No. 78-10718

The (scalar) Bohl transformation is generalized for the purpose of answering questions for self-adjoint matrix systems. A comparison-type theorem for one of the self-adjoint matrix systems is established. G.Y.

N78-29818 Texas Univ., Austin.
RUNGE-KUTTA FORMULAS WITH EXTENDED REGIONS OF STABILITY Ph.D. Thesis
Kambozia Sepehronoori 1977 147 p
Avail: Univ. Microfilms Order No. 78-07384

The development of Runge-Kutta formulas with special properties is described. These formulas have limited storage requirements and are suitable for the integration of large systems of ordinary differential equations. Furthermore, the coefficients of these formulas can be chosen such that the methods are appropriate for the integration of systems that possess certain ill-conditioned stability properties. These Runge-Kutta formulas can be used in conjunction with the method of lines for solving partial differential equations arising in a number of fields of applied mathematics. Dissert. Abstr.

N78-29819# Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
THE FINITE ELEMENT METHOD APPLIED TO A CLASS OF TIME-DEPENDENT NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS
Z. Mazhar May 1977 80 p refs
(TN-21) Avail: NTIS HC A05/MF A01

The finite element - Galerkin approximation is utilized for the solution of a class of time-dependent partial differential equations. Among the types of partial differential equations considered are unsteady linear/nonlinear heat conduction and also diffusion of a concentration in a fluid flow. A considerable number of problems are solved and compared with the available finite difference and/or variational and/or analytical solutions. Some interesting observations are also discussed parallel to the solution procedure and presentation of results. The highly sparse algebraic systems of equations are solved by means of the Gauss-Seidel iteration method. Based on the available literature and the observations had, the efficiency of the Gauss-Seidel method for this type of problems is also discussed. Triangular idealization and linear elements are used throughout the formulations. A computer program is also presented, in which, with some minor changes, higher order elements can also be utilized. Author

N78-29820*# Houston Univ., Tex. Coll. of Engineering.
APPLICATIONS OF HYBRID AND DIGITAL COMPUTATION METHODS IN AEROSPACE-RELATED SCIENCES AND ENGINEERING Final Report
C. J. Huang and R. L. Motard Jul. 1978 486 p refs
(Grant NGL-44-005-084)
(NASA-CR-157364) Avail: NTIS HC A21/MF A01 CSCL 12A

The computing equipment in the engineering systems simulation laboratory of the Houston University Cullen College of Engineering is described and its advantages are summarized. The application of computer techniques in aerospace-related research psychology and in chemical, civil, electrical, industrial, and mechanical engineering is described in abstracts of 84 individual projects and in reprints of published reports. Research supports programs in acoustics, energy technology, systems engineering, and environment management as well as aerospace engineering. A.R.H.

N78-29821# Maryland Univ., Baltimore. Div. of Mathematics and Physics.
ESTIMATION AND DETECTION OF LIE GROUPS Interim Report
James Ting-Ho Lo Oct. 1977 97 p refs
(Grant AF-AFOSR-2671-74; AF Proj. 2304)
(AD-A053633; MRR-77-11; AFOSR-78-0734TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

A new approach developed in recent years for nonlinear estimation and detection is the employment of the differential geometric techniques. In this report, this approach is surveyed and the ideas of rolling without slipping and the exponential Fourier densities are discussed in great detail. Some new results on estimation on general compact Lie groups are also included. Author (GRA)

N78-29822# Colorado State Univ., Fort Collins. Dept. of Mathematics.
ADAPTIVE PIECEWISE POLYNOMIAL L1 APPROXIMATION Interim Report
Paul G. Avila Mar. 1978 37 p refs
(Grant AF-AFOSR-2878-76)
(AD-A053651; AFOSR-78-0749TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Previously, programs had been introduced for adaptively computing smooth piecewise polynomial approximations using uniform, least-squares (L2), and restricted range uniform approximations. In this paper, a program for computing smooth piecewise polynomial L1 approximations is introduced. The adaptive curve fitting scheme employed is discussed in detail as is the algorithm used for determining the L1 approximations. Finally, numerical results are presented in an attempt to illustrate the effective use of this newly developed L1 curve fitting package. Author (GRA)

N78-29823# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
A FINITE DIFFERENCE TECHNIQUE FOR SOLVING OPTIMIZATION PROBLEMS GOVERNED BY LINEAR FUNCTIONAL DIFFERENTIAL EQUATIONS Interim Report
Douglas C. Reber Mar. 1978 70 p refs
(Grants AF-AFOSR-3092-76; NSF MCS-76-07247; AF Proj. 2304)
(AD-A053738; AFOSR-78-0727TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Aspects of the approximation and optimal control of systems governed by linear retarded nonautonomous functional differential equations (FDE) are considered. First, certain FDE are shown to be equivalent to corresponding abstract ordinary differential equations (ODE). Next, it is demonstrated that these abstract ODE may be approximated by difference equations in finite dimensional spaces. The optimal control problem for systems governed by FDE is then reduced to a sequence of mathematical programming problems. Finally, numerical results for two examples are presented and discussed. Author (GRA)

N78-29824# Stanford Univ., Calif. Systems Optimization Lab.
CONVERGENCE PROPERTIES OF A PIES-TYPE ALGORITHM FOR NON-INTEGRABLE FUNCTIONS
Caulton L. Irwin Dec. 1977 21 p refs
(Contracts N00014-75-C-0865; EY-76-S-03-0326; Grant NSF MCS-76-20019; EPRI Proj. RP652-1)
(AD-A053440; SU-SOL-77-33) Avail: NTIS HC A02/MF A01 CSCL 05/3

An algorithm for determining the market equilibrium in the presence of non-integrable but differentiable excess demand functions is developed. This can be reviewed as a variant of the Project Independence Evaluation System Algorithm. A sequence of approximate market equilibria are obtained by constructing

integrable excess demand functions. Conditions for the existence and uniqueness of the solutions are demonstrated. It is shown further that the sequence converges to the true market equilibrium if a matrix related to the demand elasticities has a spectral radius less than one. There is a close analogy to known methods for iterative solution of nonlinear equations. Geometric interpretations and some effects of coordinate transformation are discussed. Author (GRA)

N78-29825# Stanford Univ., Calif. Dept. of Statistics.
PHI SUB p-OPTIMAL SECOND ORDER DESIGNS FOR SYMMETRIC REGIONS
L. Pesotchinsky 28 Feb. 1978 37 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031; NR Proj. 042-267)
(AD-A053932; SU-TR-255; SU-TR-15) Avail: NTIS HC A03/MF A01 CSCL 12/1

Designs for quadratic regression on a cube, cube with truncated vertices, and on a ball are studied in terms of a family of criteria that includes those of A, D and E optimality. Both theoretical and numerical results on structure and performance are presented. In particular, D and E optimum designs are described and a procedure of construction of nearly robust under variation of criterion integer designs is suggested. Some examples are given for the dimensions 4, 5 and 6. GRA

N78-29826# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ESTIMATION AND IDENTIFICATION FOR MODELING DYNAMIC SYSTEMS Interim Report, 1 Mar. 1977 - 28 Feb. 1978
Jerry M. Mendel 27 Mar. 1978 10 p refs
(Grant AF-AFOSR-2797-75; AF Proj. 2304)
(AD-A053583; AFOSR-78-0767TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

Systems are modelled in order to understand and explain them better and as a prelude to action. The study has been aimed at two problem areas: multi-stage modelling estimation and identification algorithms for dynamic systems, and state estimation and a parameter identification for a new class of models -- causal functional equations -- which describe wave propagation in layered media systems. The first problem is concerned with developing estimation algorithms both for parameter and state estimation that are recursive in the dimension of the parameter vector or state vector. The second problem is concerned with developing whole new theories of state estimation and parameter identification for a new class of equations which is referred to as causal functional equations. Eight new papers were submitted or accepted for publication. Author (GRA)

N78-29827# University Coll., Cork (Ireland). Dept. of Mathematical Physics.
THE EDGE-FUNCTION METHOD (E.F.M.) Final Report, 1 Jul. 1975 - 30 Jun. 1977
Patrick M. Quinlan 1 May 1978 7 p refs Presented at Intern. Symp. on Innovative Numerical Analysis in Appl. Eng. Sci., Versailles, France, 23-27 May 1977 Submitted for publication
(Grant AF-AFOSR-2768-75)
(AD-A054265; EOARD-TR-78-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

The main algebraic and programming features of E.F.M. (Edge Function Method) are illustrated by application to Laplace's equation for polygonal regions with elliptical cavities. The Basic Functions Vertex, Edge and Mapped Polars - are obtained. Vertex equations, and Harmonic Fitting based on a discrete least squares criterion, are introduced. Extension is made to a region sub-divided into a series of elements as in E.F. work. Major areas of E.F. work Elastostatics, Thin Plates and Vibrations of Thin Elastic Shells - are sketched, and some basic problems for 3-D elasticity are solved. The main features of E.F.M. are illustrated by numerical studies on the notch problem in Elastostatics and the vibration of a thin elastic shell with a square plan form. Author (GRA)

N78-29828# Wisconsin Univ. - Madison. Mathematics Research Center.
ANALYSIS OF EVOLUTIONARY ERROR IN FINITE ELEMENT AND OTHER METHODS Ph.D. Thesis
M. J. P. Cullen and K. W. Morton Feb. 1978 37 p refs
(Contract DAAG29-75-C-0024)
(AD-A054551; MRC-TSR-1832) Avail: NTIS HC A03/MF A01 CSCL 12/1

Restriction and prolongation operators are used to provide a unified framework for the discussion of errors in approximating evolutionary equations. A generalized truncation error enables the spline-Galerkin method to be studied in detail and the accuracy of various treatments of non-linear terms (such as the advection operator v dot del(v) compared: it is shown how a multi-stage Galerkin process can give errors which are O(h to the 2mu power) for splines of order mu and quite general differential operators. A Petrov-Galerkin method is derived for partial sub t = a(partial sub x of u) which is accurate and stable. Author (GRA)

N78-29829# Arizona Univ., Tucson.
SINGULAR PERTURBATIONS, ORDER REDUCTION, AND DECOUPLING OF LARGE SCALE SYSTEMS
R. E. OMalley, Jr. and L. R. Anderson May 1978 28 p refs
(Contract N00014-76-C-0326)
(AD-A054483; Rept-21) Avail: NTIS HC A03/MF A01 CSCL 12/1

Singular perturbation methods have recently provided new techniques for optimal control and stability problems. Their primary advantage is the order reduction achieved when small parameters are set equal to zero. We present an approach for identifying small parameters by separating slow and fast modes. A computational procedure is developed for simple linear systems and tested numerically. Connections to current engineering literature is stressed. Author (GRA)

N78-29830# Wisconsin Univ., Madison. Mathematics Research Center.
FAST POISSON SOLVERS ON GENERAL TWO DIMENSIONAL REGIONS FOR THE DIRICHLET PROBLEM
A. S. L. Shieh Jan. 1978 40 p refs
(Contract DAAG29-75-C-0024)
(AD-A054539; MRC-TSR-1820) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is shown that by using the simplest construction of discrete dipoles, the operation count for solving the Dirichlet problem of Poisson's equation by the capacitance matrix method does not exceed constant times n-squared log n, n = 1/h for certain first and second order schemes of interpolating boundary conditions. Author (GRA)

N78-29831# Wisconsin Univ. - Madison. Mathematics Research Center.
A POSTERIORI ERROR BOUNDS FOR TWO-POINT VALUE PROBLEMS
Gershon Kedem Jan. 1978 70 p refs
(Contract DAAG29-75-C-0024)
(AD-A054544; MRC-TSR-1825) Avail: NTIS HC A04/MF A01 CSCL 12/1

It is shown how one can bound a posteriori the error made in the numerical solution of the Two-Point Boundary Value Problem (TPBVP). The error bounds obtained are rigorous and include the truncation and the roundoff error. In addition, the computations establish the existence of solutions to the TPBVP. GRA

N78-29832# Wisconsin Univ. - Madison. Mathematics Research Center.
AN INTEGRAL REPRESENTATION FOR EIGENFUNCTIONS OF LINEAR ORDINARY DIFFERENTIAL OPERATORS
W. Symes Jan. 1978 19 p
(Contract DAAG29-75-C-0024; NSF MCS-75-17385)
(AD-A054543; MRC-TSR-1824) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper generalizes an integral representation formula for eigenfunctions of Sturm-Liouville operators, known as the Volterra transformation operator in the theory of the inverse scattering problem, to higher-order differential operators. A specific fourth-order initial value problem is considered whose solutions are expressed as an inverse-Laplace-Borel transform. GRA

N78-29833# Wisconsin Univ. - Madison. Mathematics Research Center.
RELATIONS AMONG GENERALIZED KORTEWEG-DEVRIES SYSTEMS
W. Symes Jan. 1978 14 p refs
(Contract DAAG29-75-C-0024; NSF MCS-75-17385)
(AD-A054542; MRC-TSR-1823) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This report presents certain relations among the completely integrable Hamiltonian systems introduced by Gel'fand and Dikii. These relations generalize a formula of A. Lenard linking the higher-order Korteweg-deVries equations, of which the Gel'fand-Dikii Systems are a generalization. The general form of the relations, which connect the various isospectral deformations of linear differential operators, is described, and two examples are given explicitly. Author (GRA)

N78-29834# Wisconsin Univ. - Madison. Mathematics Research Center.
SOME OPTIMAL PROPERTIES AND INTERPRETATIONS OF PRINCIPAL COMPONENTS
Raul Hudlet and Richard A. Johnson Mar. 1978 29 p refs
(Contracts DAAG29-75-C-0024; NSF MCS-77-09574)
(AD-A054555; MRC-TSR-1836) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Optimal properties are derived and some new geometrical interpretations given for principal components. Typically, our main results concern the simultaneous minimization of eigenvalues of certain covariance matrices which measure the goodness of an approximation. Many popular criteria like total variance and generalized variance, which are increasing functions of the eigenvalues, are then minimized by the best approximator. In other situations, the criterion may not be a monotone function of the eigenvalues. A general optimal class is derived based on the non-negative definite ordering of covariance matrices. Also a result is given for the sequential selection of principal components. The final section gives a new geometrical interpretation of the sample principal components. GRA

N78-29835# Wisconsin Univ. - Madison. Mathematics Research Center.
A SET OF ORTHOGONAL POLYNOMIALS THAT GENERALIZE THE RACAH COEFFICIENTS OR 6 -J SYMBOLS
Richard Askey and James Wilson Mar. 1978 17 p refs
(Contract DAAG29-75-C-0024)
(AD-A054552; MRC-TSR-1833) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A very general set of orthogonal polynomials with five free parameters is given explicitly, the orthogonality relation is proved and the three term recurrence relation is found. Author (GRA)

N78-29836# Wisconsin Univ. - Madison. Mathematics Research Center.
UNIQUENESS OF SOLUTIONS TO HYPERBOLIC CONSERVATION LAWS
Ronald J. DiPerna Mar. 1978 40 p
(Contracts DAAG29-75-C-0024; NSF MCS-75-17385)
(AD-A054557; MRC-TSR-1838) Avail: NTIS
HC A03/MF A01 CSCL 12/1

It is known that conservative systems of differential equations which result from continuum mechanics (e.g. the equations of shallow water waves, fluid dynamics, magneto-fluid dynamics and certain elasticity problems) do not have unique solutions. Thus the problem arises of proving that systems of this type have only one physically meaningful solution. This report shows that there exists at most one solution satisfying an entropy condition which generalizes the second law of thermodynamics. GRA

N78-29837# Wisconsin Univ. - Madison. Mathematics Research Center.
QUADRATIC INTERPOLATION IS RISKY
Stephen M. Robinson Mar. 1978 9 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A054558; MRC-TSR-1839) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This brief note points out that the method of quadratic interpolation, which has been recommended in the literature for minimizing a function of one variable, can be very undependable. In particular, unless the function being minimized is itself quadratic, the method may break down no matter how close to the minimizer one starts. Author (GRA)

N78-29838# Wisconsin Univ. - Madison. Mathematics Research Center.
STUDIES IN THE ANALYSIS OF SERIALLY DEPENDENT DATA
Lars Chr. Pallesen Mar. 1978 99 p
(Contract DAAG29-75-C-0024)
(AD-A054556; MRC-TSR-1837) Avail: NTIS
HC A05/MF A01 CSCL 12/1

The analysis of linear models with independent homescedastic, normal noise (white noise) occupies a prominent position in applied statistics. This report is concerned with the linear model analysis of data which cannot be assumed statistically independent because the data have been collected sequentially in time or space. GRA

N78-29839# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE IMPLEMENTATION OF IMPLICIT RUNGE-KUTTA FORMULAE FOR THE SOLUTION OF INITIAL-VALUE PROBLEMS
A. R. Curtis Jan. 1978 28 p refs
(NPL-NAC-87) Avail: NTIS HC A03/MF A01

Practical formulae were developed for using implicit Runge-Kutta formulae to solve initial value problems in ordinary differential equations. The region of absolute stability of the method is maximal and the resulting algorithm is effective for some types of stiff systems that would defeat the classical method of Gear. Author (ESA)

N78-29840# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Scholarly Communications with the People's Republic of China.
PURE AND APPLIED MATHEMATICS IN THE PEOPLE'S REPUBLIC OF CHINA
Anne Fitzgerald, ed. and Saunders MacLane, ed. Jul. 1977 126 p Sponsored by Amer. Council of Learned Societies, New York
(PB-279509/4; ISBN-0-309-02609-1; CSCPRC-3;
LC-77-79329) Avail: NTIS HC A07/MF A01 CSCL 12A

Topics discussed include the following: mathematics in China up to 1966; politics in command-the political setting for Chinese mathematical activity; research institutes and universities; present status of mathematical research and abstracts of lectures by Chinese mathematicians; mathematical education. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-29841 Texas Technological Univ., Lubbock.
PROPERTIES OF CERTAIN GENERALIZED POWER SERIES DISTRIBUTIONS Ph.D. Thesis
Larry Dwayne Snider 1977 137 p
Avail: Univ. Microfilms Order No. 78-10855

Several results about a family of discrete distributions called generalized power series distributions are presented. The first topics concern continuity correction for normal approximations. The one-sample problem is as follows: when a discrete probability is approximated by a normal probability, 0.5 is often used as a continuity correction. The two-sample problem deals with the distribution of Y-X where Y and X are independent and have identical poisson, binomial, or negative binomial distributions. The third topic concerns necessary conditions for a sequence of standardized generalized power series distributions to approach a normal distribution. The last topic deals with the situation where $P(Y/X)$ is known to be a generalized power series distribution and $E(X/Y=Y)$ is given. Dissert. Abstr.

N78-29842 Southern Methodist Univ., Dallas, Tex.
PROPERTIES OF ORDINARY AND WEIGHTED LEAST SQUARES ESTIMATORS OF REGRESSION COEFFICIENTS

FOR TWO-STAGE SAMPLES Ph.D. Thesis
Cathy Campbell 1977 192 p
Avail: Univ. Microfilms Order No. 78-09991

A linear regression model with nested (two stage) error structure is presented, and various aspects of the estimation of the regression coefficients are discussed. Primary emphasis is placed on comparing the BLU weighted least squares (WLS) estimator with the non-optimal but widely used ordinary least squares (OLS) estimator. Using singular decompositions of pertinent matrices, compact and easily comparable forms for the variance matrices of the two estimators are developed. Then a detailed study of the relative efficiency of OLS with respect to WLS is undertaken. For simple linear regression, the properties of the relative efficiency are fully developed both algebraically and numerically. Three different efficiency measures are presented that are appropriate for multiple regression. Algebraic results are given. Finally sample survey applications of the two state model are explored via a super population model. Dissert. Abstr.

N78-29843*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A STATISTICAL PACKAGE FOR COMPUTING TIME AND FREQUENCY DOMAIN ANALYSIS
James Brownlow Aug. 1978 80 p refs
(NASA-TM-56045; H-981) Avail: NTIS HC A04/MF A01 CSCL 12A

The spectrum analysis (SPA) program is a general purpose digital computer program designed to aid in data analysis. The program does time and frequency domain statistical analyses as well as some preanalysis data preparation. The capabilities of the SPA program include linear trend removal and/or digital filtering of data, plotting and/or listing of both filtered and unfiltered data, time domain statistical characterization of data, and frequency domain statistical characterization of data. Author

N78-29844# California Univ., Los Angeles.
ADVANCES IN FILTERING TECHNIQUES FOR STOCHASTIC SYSTEMS WITH UNCERTAIN PARAMETERS, PART 1 Ph.D. Thesis
Calvin Chris Schneider, Jr. 1978 294 p refs
(Contract F04701-77-C-0090)
(AD-A054396) Avail: NTIS HC A13/MF A01 CSCL 12/1

Optimum estimation of the states of linear dynamic processes using noise corrupted measurements, commonly referred to as Kalman filtering, requires an exact knowledge of the equations which govern the complete stochastic system. In practical applications, however, these equations depend on parameters which can not be precisely defined. When the parameter uncertainties are sufficiently large, standard filtering techniques can produce inaccurate and inadequate estimates. In this dissertation, two alternative techniques of state estimation for systems with uncertain parameters are considered. GRA

N78-29845# Naval Surface Weapons Center, White Oak, Md. Advanced Weapons Dept.
AN INVERSE REGRESSION METHOD FOR DETERMINING AN ENSEMBLE OF STATE ERROR VECTORS FROM A COVARIANCE MATRIX Interim Report
Ronald S. Brunsvold 5 Dec. 1977 37 p
(AD-A054214; NSWC/WOL/TR-77-183) Avail: NTIS HC A03/MF A01 CSCL 12/1

A method is described to determine an ensemble of initial condition state vector errors for use in a Monte-Carlo type error model. The state vector errors are found from a given (N x N) error covarance matrix and are properly correlated with one another. The method used is an inverse regression scheme which randomly introduces a gaussion distribution of errors with determined variances about linear regression curves calculated from the given covariance Matrix. A FORTRAN coded implementation of the method is included. Author (GRA)

N78-29846# Wisconsin Univ. - Madison. Mathematics Research Center.
ADAPTIVE MINIMUM MEAN SQUARE ERROR FORECAST OF MISSILE TRAJECTORY USING STOCHASTIC DIFFERENCE EQUATION MODELS
G. E. P. Box and Lars Chr. Pallesen Jan. 1978 31 p
(Contract DAAG29-75-C-0024)
(AD-A054540; MRC-TSR-1821) Avail: NTIS HC A03/MF A01 CSCL 12/1

Data projection (forecasting) methods are illustrated using missile data supplied by Quality Evaluation Division of White Sands Missile Range. The process of model building making iterative use of identification (using the autocorrelation function) fitting (maximum likelihood estimation) and diagnostic checking (analysis residuals) is illustrated in the building of an appropriate stochastic difference equation model. It is shown in detail how all the following may be calculated directly from the model: the projection (forecast) function, the memory function, the error of the projected value at any lead time; and the updating of the projection function. GRA

N78-29847# Wisconsin Univ. - Madison. Mathematics Research Center.
A FUBINI THEOREM FOR ITERATED STOCHASTIC INTEGRALS
Marc A. Berger Feb. 1978 37 p refs
(Contract DAAG29-75-C-0024; NSF MCS-75-17385)
(AD-A054545; MRC-TSR-1826) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report extends the stochastic integral of Ito to allow for a certain class of anticipating integrals. Probabilistic and computational results concerning this extension are presented and iterated integrals are discussed. The motivation for this extension stems from the Ito-Volterra equation. This equation arises from feedback in the presence of white noise, and cannot be inverted using classical stochastic integrals. The inversion involving the extended integrals appears at the end of the report. Author (GRA)

N78-29848# Wisconsin Univ. - Madison. Mathematics Research Center.
THE USE OF STOCHASTIC PROGRAMMING FOR THE SOLUTION OF SOME PROBLEMS IN STATISTICS AND PROBABILITY
Andras Prekopa Mar. 1978 23 p refs
(Contract DAAG29-75-C-0024)
(AD-A054553; MRC-TSR-1834) Avail: NTIS HC A02/MF A01 CSCL 12/1

The applicability of known stochastic programming models and methods for the solution of problems in classical statistics and probability is shown by a number of examples. These concern testing of hypotheses, constructing of tolerance regions, planning of optimal sampling and the Moran model for the dam. Author (GRA)

N78-29849# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
MOVING AVERAGE MODELS: TIME SERIES IN M-DIMENSIONS
D. A. Voss, C. A. Oprian, and L. A. Aroian 15 Jan. 1978 27 p refs
(Contract N00014-77-C-0438)
(AD-A054585; AES-7802) Avail: NTIS HC A03/MF A01 CSCL 12/1

Stochastic models for discrete time series in the time domain are well known but such models lack consideration of spatial dependency. We expand on their work by constructing spatially depending moving average models. Definitions of order, stationarity, invertibility, autocorrelation function, and spectrum are made as natural extensions of those in zero dimensions and are implemented in the one and two-space dimensional models. Author (GRA)

N78-29850# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
TIME SERIES IN M DIMENSIONS: DEFINITION, PROBLEMS AND PROSPECTS
Leo A. Aroian 15 Jan. 1978 20 p refs
(Contract N00014-77-C-0438)
(AD-A054584; AES-7801) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of this paper is to define and to consider the problems and prospects of time series in m dimensions. First, the definition of time series in m dimensions, secondly its relationship to time series in zero dimensions, whether stationary

or not, and finally, the relationship to correlation theory in m dimensions will be considered. GRA

N78-29851# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
TIME SERIES IN M DIMENSIONS: AUTOREGRESSIVE MODELS
Vida S. Taneja and Leo A. Aroian 15 Jan. 1978 21 p refs (Contract N00014-77-C-0438)
(AD-A054586; AES-7803) Avail: NTIS HC A02/MF A01 CSCL 12/1

Spatially dependent autoregressive models in m dimensions are defined. The conditions for stationarity and invertibility are determined. The autocorrelation function and Yule-Walker equations are obtained for the general case. GRA

N78-29852# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
INTERRELATIONSHIPS BETWEEN AUTOREGRESSIVE AND MOVING AVERAGE MODELS - THE ARMA MODEL: GENERAL CONSIDERATIONS IN M DIMENSIONS
C. A. Oprian, V. S. Taneja, D. A. Voss, and L. A. Aroian 15 Jan. 1978 28 p refs
(Contract N00014-77-C-0438)
(AD-A054587; AES-7804) Avail: NTIS HC A03/MF A01 CSCL 12/1

The paper describes a general linear stochastic model which supposes a time series to be generated by a linear aggregation of random shocks at various temporal and spatial locations. Author (GRA)

N78-29853# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
REDUCTION AND SMOOTHING OF MULTIVARIATE TIME SERIES WITH CURVE FITTING METHODS
J. J. Renes 9 May 1977 16 p refs Presented at the 1st World Conf. on Math. at the Service of Man, Barcelona, 11-16 Jul. 1977
(NLR-MP-77014-U) Avail: NTIS HC A02/MF A01

Least squares curve fitting with splines is used to reduce and smooth large amounts of data from measurements. Unknown parameters in systematic measuring errors can be estimated together with the coefficients that define the curve when various data streams are processed simultaneously. The accurate reconstruction of an aircraft flight path in the vertical plane during part of the takeoff is given as an example. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-29854 Cornell Univ., Ithaca, N. Y.
CONTRIBUTIONS TO THE THEORY OF GENERALIZED BLOCK DESIGNS Ph.D. Thesis
Muhammad Shafiq 1978 109 p
Avail: Univ. Microfilms Order No. 78-09519

The results of this dissertation can be summarized as follows: (1) The extension of some of the theory from basic N-ary balanced incomplete block design to generalized N-ary balanced block design; (2) the extension of some of the theory of basic binary partially balanced incomplete block design to generalized binary partially balanced block design; (3) developed criteria of optimality; (4) generalized Fisher's inequality v less than or equal to b for basic binary designs to basic and generalized N-ary designs; and (5) generalized a result of Bose and Mesner on association algebra. Dissert. Abstr.

N78-29855 Kansas State Univ., Manhattan.
THE THRESHOLD POINT MODEL Ph.D. Thesis
Jeanne Lou Sebaugh 1977 61 p
Avail: Univ. Microfilms Order No. 7811438

The threshold point model is defined as one consisting of two intersecting line segments, one of which has a positive or negative (nonzero) slope and the other has zero slope, i.e., is a constant. The threshold point model is further classified as either a stable point or a critical point model, depending on whether the values of the dependent variable are fairly stable or whether they fluctuate widely about the constant. Easy to follow steps for estimating the parameters of the model and their confidence intervals are given and illustrated numerically using the statistical analysis system. A mathematical formulation is given for extending the model to include other nonthreshold independent variables. This allows use of the model for analysis of variance models with multiple classifications. The procedures are illustrated numerically for a model with one threshold and one nonthreshold independent variable. Dissert. Abstr.

N78-29856# Florence Univ. (Italy). Ist. di Elettronica.
LARGE CHANGE SENSITIVITY FIGURE AND NEW ALGORITHM FOR ITS MINIMIZATION
P. Barbini, A. Liberatore, and G. Mazzoni 1977 17 p refs Sponsored in part by CNR
(R-9-77) Avail: NTIS HC A02/MF A01

A figure of statistical multiparametric sensitivity for large parameter changes was studied; a new algorithm for the minimization of this figure is presented. The algorithm is shown to be simple and less dependent on either the form of the feasible region or the complexity of the objective function. The algorithm is also useful for the solution of any optimization problem, expecially in cases in which the objective function and constraints quickly change. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-29857 Oregon Univ., Eugene.
THE GEOMETRY OF DIFFERENTIABLE FUNCTIONS ON CLOSED SUBSETS OF EUCLIDEAN SPACE Ph.D. Thesis
Bryan Campbell Dorner 1977 94 p
Avail: Univ. Microfilms Order No. 78-10193

The Whitney algebra, W to the k power (X), of a closed subset X in the Euclidean n-space is the primary objective of this study. E. Geometric conditions on X are used to derive information about W to the k power (X). The relation between W to the k power (X) and other natural function algebras on X is given particular attention. The inverse problem of how much the geometry of X is controlled by W to the k power is also considered. The principle results in these directions are reported. Dissert. Abstr.

N78-29858 Brown Univ., Providence, R. I.
CODIMENSION ONE ISOMETRIC IMMERSIONS BETWEEN LORENTZ SPACES Ph.D. Thesis
Larry King Graves 1977 77 p
Avail: Univ. Microfilms Order No. 78-09061

Isometric immersions of the n-dimensional Lorentz space into the (n+1)-dimensional Lorentz space are studied. A class of immersions of the Lorentz plane into Lorentz 3 space, called the class of B-scroll immersions, is described. The classification results are reported. Dissert. Abstr.

N78-29859 California Univ., San Diego.
THE APPLICATION OF CONVEX REGULARIZATION TO TCHEBYCHEFF SYSTEMS Ph.D. Thesis
Cory Bruce Smith 1978 194 p
Avail: Univ. Microfilms Order No. 78-10580

Regularized convex programs of the form which minimize k(k - Tx) + tau c(x) subject to linear equality constraints and nonnegativity constraints on the variable vector or function x in a linear space L sq (S). The convex functions k and c are assumed to be twice continuously differentiable. The linear transformation T: Lsq (S) yields E to the m power consists of continuous transfer functions Ti that form a Tchebycheff system on the set S, which is either finite or a closed real interval with Lebesgue measure. A dual approach based on conjugate convex functions is developed for the solution of the regularized problem, and an algorithm using a Newton/descent method is given for a dual problem. In the case of a separable regularizing function c(X) the dual problem is an unconstrained convex program in m dimensional space, E to the m power. The algorithm is applied

to medical inert gas retention data, where the transfer matrix T is a 6x49 Cauchy system based on a parallel unit model of the lungs. Dissert. Abstr.

N78-29860 Alabama Univ., University.
REGULAR TRANSFORMATION GROUPS AND HOMOMORPHISMS Ph.D. Thesis
Moo Ha Woo 1977 51 p
Avail: Univ. Microfilms Order No. 7809887

The concept of regular transformation groups is developed by comparing regular minimal sets with minimal proximal transformation groups and introducing regular homomorphisms. Relations between regular minimal sets and minimal proximal transformation groups are shown. A necessary sufficient condition for a transformation group to be proximal is given. The concept of regular transformation groups as a generalization of regular minimal sets and proximal transformation groups is developed and it is shown that the proximal relation of a transformation group is an equivalence relation if and only if the enveloping semigroup is a regular transformation group. Regular homomorphisms are defined. It is shown that these homomorphisms and certain subgroups of the automorphism group of the universal minimal set are closely related. A relation between regular homomorphisms and bitransformation groups is given.
Dissert. Abstr.

N78-29861# Wisconsin Univ. - Madison. Mathematics Research Center.
APPROXIMATION OF CONVEX SET-VALUED FUNCTIONS
Richard A. Vitale Jan. 1978 23 p refs
(Contract DAAG29-75-C-0024)
(AD-A054541; MRC-TSR-1822) Avail: NTIS HC A02/MF A01 CSCL 12/1

Approximation of set-valued functions is introduced and discussed under a convexity assumption. In particular, a theorem of Korovkin type is derived for a class of approximation methods. Author (GRA)

N78-29862# Wisconsin Univ. - Madison. Mathematics Research Center.
STRONG CONVERGENCE OF SEMIGROUPS OF NONLINEAR CONTRACTIONS IN HILBERT SPACE
A. Pazy Feb. 1978 42 p refs
(Contract DAAG29-75-C-0024)
(AD-A054547; MRC-TSR-1828) Avail: NTIS HC A03/MF A01 CSCL 12/1

The present paper deals with the strong convergence of trajectories S(t)x of a strongly continuous semigroup of contractions S(t), as t approaches infinity. A general sufficient condition for such convergence to occur is introduced and some examples in which the condition is satisfied are provided. Strengthening the general convergence condition, sufficient conditions for certain rates of convergence of S(t)x to its limit are exhibited. In particular a sufficient condition for a trajectory to reach equilibrium in finite time is given. The convergence as t approaches infinity of solutions of certain nonautonomous equations and a discrete version of all the previous results are briefly discussed.
Author (GRA)

N78-29863# Wisconsin Univ. - Madison. Mathematics Research Center.
A VARIATIONAL EQUIVALENT TO DIAGONAL SCALING
C. T. Kelley Feb. 1978 20 p refs
(Contracts DAAG29-75-C-0024; NSF MCS-75-17385)
(AD-A054548; MRC-TSR-1829) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is concerned with the problem of diagonally scaling a given nonnegative matrix a to one with prescribed row and column sums. The approach is to represent one of the two scaling matrices as the solution of a variational problem. This leads in a natural way to necessary and sufficient conditions on the zero pattern of a so that such a scaling exists. In addition the convergence of the successive prescribed row and column sum normalizations is established. Certain invariants under diagonal scaling are used to actually compute the desired scaled matrix, and examples are provided. Finally, at the end of the paper, a discussion of infinite systems is presented.
Author (GRA)

N78-29864# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON A DISCRETE RODRIGUES' FORMULA AND A SECOND CLASS OF ORTHOGONAL HAHN POLYNOMIALS
Kjell Hopmaaker 1977 15 p refs
(CTH-Math-1977-12) Avail: NTIS HC A02/MF A01

A search for orthogonal polynomials of a discrete variable that can be derived from a discrete analog of Rodrigues' formula is performed. This question has been treated before, but one possibility seems to have been overlooked, namely, a second class of orthogonal Hahn polynomials. Some properties of these Hahn polynomials are shown, in particular an asymptotic expansion which shows the connection with the Hermite polynomials.
Author (ESA)

N78-29865# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
STABILITY PROPERTIES OF A NONLINEAR DIFFERENTIAL SYSTEM IN APPLIED MATHEMATICS
Ingvar Mellander 1977 28 p refs
(CTH-Math-1977-15) Avail: NTIS HC A03/MF A01

A nonlinear differential system arising in sand mechanics was studied. The existence of an infinitely old solution was established. This reduces to a periodic solution and an equilibrium solution in the periodic and autonomous cases, respectively. Global asymptotic stability holds in all cases. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-29866# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
DISSEMINATING STANDARDS OF TIME AND FREQUENCY: ISSUES IN THE EVALUATION OF ALTERNATIVE SYSTEMS Final Report, Jan. 1976 - Apr. 1977
Richard H. F. Jackson Mar. 1978 33 p refs
(PB-279684/5; NBSIR-78-874) Avail: NTIS HC A08/MF A01 CSCL 14B

The primary purpose of this report is to document the economic issues involved in this study by discussing the problem in terms of both cost-benefit analysis and cost-effectiveness analysis. Preliminary cost studies for some of the dissemination alternatives are also included. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-29867*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
FLIGHT EFFECTS ON THE AERODYNAMIC AND ACOUSTIC CHARACTERISTICS OF INVERTED PROFILE COANNULAR NOZZLES, VOLUME 1 Final Report
Hilary Kozlowski and Allan B. Packman Jun. 1978 174 p 3 Vol.
(Contract NAS3-17866)
(NASA-CR-135189-Vol-1; PWA-5509-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 20A

Jet noise spectra obtained at static conditions from an acoustic wind tunnel and an outdoor facility are compared. Data curves are presented for (1) the effect of relative velocity on OASPL directivity (all configurations); (2) the effect of relative velocity on noise spectra (all configurations); (3) the effect of velocity on PNL directivity (coannular nozzle configurations); (4) nozzle exhaust plume velocity profiles; and (5) the effect of relative velocity on aerodynamic performance. A.R.H.

N78-29868*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

FLIGHT EFFECTS ON THE AERODYNAMIC AND ACOUSTIC CHARACTERISTICS OF INVERTED PROFILE COANNULAR NOZZLES, VOLUME 2 Final Report

Hilary Kozlowski and Allan B. Packman Jun. 1978 478 p 3 Vol.

(Contract NAS3-17866)

(NASA-CR-135189-Vol-2; PWA-5509-Vol-2) Avail: NTIS HC A21/MF A01 CSCL 20A

Data from the acoustic tests of the convergent reference nozzle and the 0.75 area ratio coannular nozzle are presented in tables. Data processing routines used to scale the acoustic data and to correct the data for atmospheric attenuation are included. A.R.H.

N78-29869*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

FLIGHT EFFECTS ON THE AERODYNAMIC AND ACOUSTIC CHARACTERISTICS OF INVERTED PROFILE COANNULAR NOZZLES, VOLUME 3 Final Report

Hilary Kozlowski and Allan B. Packman Jun. 1978 433 p 3 Vol.

(Contract NAS3-17866)

(NASA-CR-135189-Vol-3; PWA-5509-Vol-3) Avail: NTIS HC A19/MF A01 CSCL 20A

Acoustic data from tests of the 0.75 area ratio coannular nozzle with ejector and the 1.2 area ratio coannular are presented in tables. Aerodynamic data acquired for the four test configurations are included. A.R.H.

N78-29870*# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

AN INVESTIGATION OF ROTOR NOISE GENERATION BY AERODYNAMIC DISTURBANCE

C. E. Whitfield Sep. 1977 135 p refs Sponsored by NASA (NASA-CR-157571; TT-7711) Avail: NTIS HC A07/MF A01 CSCL 20A

An open rotor was considered as a process for converting an unsteady velocity inflow into sound radiation. With the aid of crude assumptions, aero-acoustic transfer functions were defined theoretically for both discrete frequency and broad band noise. A study of the validity of these transfer functions yielded results which show good agreement at discrete frequencies though slightly less good for broad band noise. Agreement in both cases holds over three or more decades of the relevant parameters. A rotating hot wire anemometry system consisting of a single hot wire probe mounted in the nose cone of the rotor was used to quantify fluctuations in the airflow onto a single rotor blade for the transfer function results. Further theoretical analysis revealed that the sound field can be expressed in terms of blade-to-blade correlations in the airflow, and results from two probes rotating simultaneously were modelled mathematically and inserted in the theory. Preliminary results snow encouraging agreement with experimental data. A.R.H.

N78-29871*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A PHASE INSENSITIVE ULTRASONIC TRANSDUCER Patent Application

Joseph S. Heyman, inventor (to NASA) Filed 26 Jul. 1978 16 p

(NASA-Case-Lar-12304-1; US-Patent-Appl-SN-928130) Avail: NTIS HC A02/MF A01 CSCL 20A

An ultrasonic transducer that is phase insensitive, includes a cadmium sulfide crystal with two electrodes attached. The crystal is annealed for a period of time and at a temperature to provide substantially maximum acoustic attenuation at the operating frequency of the transducer. This is done by making the ultrasonic angular frequency equal to the conductivity frequency where the conductivity frequency is the conductivity divided by the dielectric permitivity. When connected in a receiver circuit, one of the electrodes of the transducer is placed as a reference for the electronics and the other electrode is connected through amplifier means to a signal processing system. An external backing material matched to the acoustic impedance of the crystal is attached to one electrode. NASA

N78-29872# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 1: ACOUSTIC DATA ON MILITARY AIRCRAFT

Jerry D. Speakman, Robert G. Powell, and John N. Cole Nov. 1977 51 p refs

(AF Proj. 7231)

(AD-A053699; AMRL-TR-73-110-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01/2

This report is one of a series describing the research program undertaken by the Aerospace Medical Research Laboratory to develop the procedures (NOISEMAP) and data base (NOISEFILE) for predicting community noise exposure resulting from military aircraft operations. It presents the results of field test measurements to define the single event noise produced on the ground by military fixed wing aircraft during controlled level flyovers and ground runups. For flight conditions, data are presented in terms of various acoustic measures over the range 200-25,000 feet minimum slant distance to the aircraft. For ground runups, data are presented as a function of angle and distance to the aircraft. All of the data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity. This particular volume (Vol. 1) discusses the scope, limitations, and definitions needed to understand and use the subsequent volumes containing the noisefile data for military aircraft. GRA

N78-29873# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 4: ACOUSTIC DATA ON AIR FORCE TRAINER/FIGHTER AIRCRAFT

Jerry D. Speakman, Robert G. Powell, and Robert A. Lee Feb. 1978 644 p

(AF Proj. 7231)

(AD-A053702; AMRL-TR-73-110-Vol-4) Avail: NTIS HC A99/MF A01 CSCL 01/2

This report presents the results of field test measurements to define the noise produced on the ground by military, fixed wing aircraft during controlled level flyovers and ground runups. For flight conditions, data are presented in terms of various acoustic measures over the range 200-25,000 feet minimum slant distance to the aircraft. For ground runups, data are presented as a function of angle and distance to the aircraft. All of the data are normalized to standard acoustic reference conditions of 59 deg. F temperature and 70% relative humidity. Noise data are presented in this Volume 4 for the following aircraft: F-100C, D, F; F-101B, C, F; F-102A; F-105B, D, F, G; F-106A, B; T-33A; T-37B; T-38A; T-39A, B, F; T-43A; and U-2. GRA

N78-29874# Naval Research Lab., Washington, D. C. Underwater Sound Reference Div.

HYDROPHONE PREAMPLIFIER OPTIMIZATION: PREDICTION OF HYDROPHONE SELF-NOISE BY A NOISE MODEL Interim Report

Allan C. Tims 17 Mar. 1978 23 p refs

(ZF11121003)

(AD-A053449; NRL-8180) Avail: NTIS HC A02/MF A01 CSCL 17/1

This report presents analysis of the self-noise which determines the threshold pressure level in hydrophone designs. The noise present in the acoustic sensor, coupling network, and preamplifier input stage are represented by an equivalent circuit noise model. A model provides an effective method to predict in advance of sensor-preamplifier construction the noise levels expected for a specific design. Author (GRA)

N78-29875# Naval Research Lab., Washington, D. C. Acoustics Div.

A LOW-FREQUENCY LIMITATION OF FACT Interim Report

Raymond M. Fitzgerald 31 Jan. 1978 13 p refs

(XF52552701)

(AD-A054371; AD-E000152; NRL-8186) Avail: NTIS HC A02/MF A01 CSCL 20/1

The inapplicability of the Fast Asymptotic Coherent Transmission (FACT) ray trace model at 14 Hz is demonstrated by comparison with normal mode calculations whose predictions have been experimentally confirmed. Author (GRA)

N78-29876# ARO, Inc., Arnold Air Force Station, Tenn.
SUPPRESSION OF PERFORATED WALL IN A TRANSONIC WIND TUNNEL AND THE EFFECTS ON AERODYNAMIC DATA Final Report, 1 Oct. 1976 - 30 Sep. 1977
J. L. Jacocks and R. L. Parker, Jr. AEDC May 1978 51 p refs
(AD-A054417; AEDC-TR-78-20) Avail: NTIS HC A04/MF A01 CSCL 20/4

Tests were conducted to determine the effect of screen overlays installed on the airside test section walls for the purpose of suppressing the wall noise. Data are presented to illustrate that the screens and resulting noise reduction affected the test section logitudinal flow uniformity, plenum-stream calibration, wave cancellation properties of the walls, transition Reynolds number, and shock/boundary-layer interaction. In general, the effect of noise reduction on viscous phenomena was similar to that observed with decreased Reynolds number. GRA

N78-29877# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
THE PREDICTION OF AERODYNAMIC AND WHEEL/RAIL NOISE GENERATED BY HIGH-SPEED TRAINS
W. F. King, III 1977 34 p refs
(DLR-IB-257-77/14) Avail: NTIS HC A03/MF A01

Wheel/rail interactions and aerodynamic fluctuations are the important sources of wayside noise produced by high-speed railway trains. The dominance of one or the other of these sources depends entirely on the relative effectivenss of each in generating radiated noise. Equations are given for the calculation of both the wheel/rail and aerodynamic noise levels and their predictions are compared to peak noise levels measured during the passage of conventional fast trains, new high-speed trains, and magnetically levitated vehicles. For the quietest new trains built with state-of-the-art technology, the analysis presented indicates that aerodynamic fluctuations can become the dominant source of wayside noise at vehicle speeds between 250 and 300 km/h (155 and 187 mph). Author (ESA)

N78-29878# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
ON ESTIMATING THE SOUND RADIATION OF LARGE RADIAL VENTILATORS FROM ACOUSTIC MEASUREMENTS AT A MODEL TEST STAND [EINE ABSCHAETZUNG DER SCHALLABSTRAHLUNG GROSSER RADIALVENTILATOREN AUS SCHALLMESSUNGEN AM MODELLPRUEFSTAND]
M. Bartenwerfer Oct. 1977 34 p refs In GERMAN Report will also be announced as translation (ESA-TT-480)
(DLR-IB-257-77/2) Avail: NTIS HC A03/MF A01

An elementary description of noise passing through walls and openings led to formulas approximating the noise radiation of a ventilator. From pressure levels measured in an exhaust channel of the test stand for the original or for a geometrically similar model, the A (DIN 45633) and the unweighted sound power level of the ventilator or the average pressure level at a shell surface could be calculated. ESA

N78-29879# National Technical Information Service, Springfield, Va.
ULTRASONICS IN MEDICINE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1978
Pernell W. Crockett May 1978 91 p Supersedes NTIS/PS/77/0452; NTIS/PS-76/0344; NTIS/PS-75/175
(NTIS/PS-78/0494/1; NTIS/PS-77/0452; NTIS/PS-76/0344; NTIS/PS-75/175) Avail: NTIS HC $28.00/MF $28.00 CSCL 06E

Federally-funded research reports on the use of ultrasound in diagnosis and therapy are cited in this bibliography. Topics cover ultrasonic imaging techniques, echoencephalography, echocardiography, use of ultrasound in bone surgery, and ultrasonic instrumentation. (This updated bibliography contains 85 abstracts, 14 of which are new entries to the previous edition.) GRA

N78-29880# National Technical Information Service, Springfield, Va.
ULTRASONICS IN MEDICINE, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Apr. 1978
Pernell W. Crockett May 1978 303 p Supersedes NTIS/PS-77/0453; NTIS/PS-76/0346
(NTIS/PS-78/0495/8; NTIS/PS-77/0453; NTIS/PS-76/0346) Avail: NTIS HC $28.00/MF $28.00 CSCL 06E

Research reports on the applications of ultrasound to diagnosis and therapy are cited from worldwide literature. Information is presented on ultrasonic imaging techniques, echoencephalography, echocardiography, use of ultrasound in surgery, and ultrasonic instrumentation in biomedical measurement. (This updated bibliography contains 296 abstracts, 98 of which are new entries to the previous edition.) GRA

N78-29881# National Technical Information Service, Springfield, Va.
USE OF ULTRASONICS IN MANUFACTURING PROCEDURES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978
Guy E. Habercom, Jr. May 1978 170 p Supersedes NTIS/PS-77/0450; NTIS/PS-76/0417; NTIS/PS-75/244
(NTIS/PS-78/0483/4; NTIS/PS-77/0450; NTIS/PS-76/0417; NTIS/PS-75/244) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Ultrasonic fabrication techniques and tools are investigated. Ultrasonic welding, heating, compacting, and cleaning are among the methods reviewed. GRA

N78-29057*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE PREDICTION TECHNOLOGY FOR CTOL AIRCRAFT
John P. Raney *In its* CTOL Transport Technol., 1978 p 805-818 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 20A

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-29882 Florida Univ., Gainesville.
CALCULATION OF ELECTRON BINDING ENERGIES Ph.D. Thesis
Henry Allan Kurtz 1977 104 p
Avail: Univ. Microfilms Order No. 7810967

Contributions from relaxation and correlation effects are examined for ionization energies and electron affinities. The delta SCF and TOM methods are compared and shown to be not the same through third order in Rayleigh-Schrodinger perturbation theory as had previously been thought. A direct method of obtaining values for ionization energies and electron affinities is proposed which includes the complete relaxation correction and an approximate correlation correction. This method is used to evaluate ionization energies for water and neon and to evaluate the electron affinity of lithium hydride. The results compare very favorably with both the experimental and other theoretical calculations. Negative electron affinities are also discussed. A method is derived to compute Harris phase shifts from which the resonance parameters can be obtained. Dissert. Abstr.

N78-29883 Brown Univ., Providence, R. I.
KINETIC DESCRIPTION OF INTERACTION OF RADIATION WITH TWO- AND THREE-LEVEL MOLECULAR SYSTEMS Ph.D. Thesis
Jitendra Singh Goela 1977 112 p
Avail: Univ. Microfilms Order No. 78-09060

The interaction of radiation with two- and three-level molecular systems is considered within the framework of Boltzmann equation in velocity distributions and the radiative transfer equation in the photon distribution function. The following effects are included: inhomogeneous and homogeneous broadening, elastic and inelastic collisions, and linear single photon and nonlinear two photon processes. The regions of validity of the rate equation formalism are obtained and the effect of departures from an equilibrium velocity distribution and a Boltzmann distribution of

rotational states is discussed. With the inclusion of a new molecular parameter, both atomic and molecular systems are considered. A better physical understanding of collisional and radiative interactions is obtained and their collisional and radiative interactions is obtained and their effects on laser performance characteristics are studied. Dissert. Abstr.

N78-29884 Columbia Univ., New York.
LIFETIMES OF EXCITED STATES OF BARIUM AND LANTHANUM AND THE MODIFICATION OF THE HANLE EFFECT BY STRONG OPTICAL PUMPING Ph.D. Thesis
Arthur Joseph Glassman 1978 244 p
Avail: Univ. Microfilms Order No. 78-09902

The dependence of optical pumping signals, as a function of such parameters as light polarization, residual magnetic field, interaction time, mean pumping rate, and laser spectral profile asymmetry, was studied theoretically. The theoretical formulation was used to compute line shapes for excited state Hanle effect signals modified by strong optical pumping of the initial state. It is found that for a particular choice of parameters the optical pumping signal is minimized, making possible measurement of the excited state lifetime by the Hanle effect in the usual manner, without the problem of deconvoluting the opitcal pumping contributions from the answer. The lifetime of excited states of barium and lanthanum were measured and discussed.
Dissert. Abstr.

N78-29885 Georgia Inst. of Tech., Atlanta.
SELECTED TOPICS FROM THE THEORY OF ELECTRON-ATOM AND ATOM-ATOM COLLISIONS Ph.D. Thesis
Walter Frederick Morrison, Jr. 1978 196 p
Avail: Univ. Microfilms Order No. 7810005

The quantal phase shifts for H(+) - (He, Ne, Ar, Kr), K(+) - (He, Ne), and Li(+) He systems were calculated using interaction potentials obtained from the literature. The phase shifts were calculated over the range k = .01 a.u. - 20 a.u. where k is the relative ion - atom momentum: The phase shifts were obtained by numerically integrating the radial equation, using a Numerov integrator, and matching the numerical and asymptotic solutions at large r. The quantal elastic, diffusion, and viscosity cross sections were determined for the ion-rare gas systems mentioned above over the stated range of relative momenta by means of standard phase shift sums over angular momentum. For low relative momenta, as few as 30 phase shifts were necessary for covergence of the sum, while at the highest relative momenta as many as 200 phase shifts were required. Dissert. Abstr.

N78-29886 North Carolina Univ. at Chapel Hill.
CALCULATIONS OF ATOMIC INNER-SHELL VACANCY YIELDS AND THEIR DEPENDENCE ON COLLISION PARAMETERS Ph.D. Thesis
Jiun-Tsong Wu 1977 82 p
Avail: Univ. Microfilms Order No. 78-10530

Vacancy production probabilities of inner shell electrons in collisions between ions and atoms are calculated by two different methods, both based on a semiclassical impact parameter approximation. Calculations are made for L-shell ionization with zero impact parameter for the projectile. The time dependent radial functions for the electron are expanded in a discrete Sturmian basis. The coupled state equations of motion are derived, and their numerical integration is carried out for different projectile velocities and charges. An isotropic harmonic oscillator is used as a model for the atomic electron. Its wave function is separated in cylindrical coordinates. Expressions for the transition probabilities with zero impact parameter are derived for the states in the 2p shell with m=0 and m=+1. They are evaluated and summed over the final states for different incident projectile energies. Contributions to the vacancy production probabilities by longitudinal and transverse excitation, as defined by the beam direction, are discussed. Dissert. Abstr.

N78-29887 Cornell Univ., Ithaca, N. Y.
HIGH ORDER CONTRIBUTIONS TO THE HYPERFINE STRUCTURE IN POSITRONIUM AND MUONIUM Ph.D. Thesis
Geoffrey Thomas Bodwin 1978 100 p
Avail: Univ. Microfilms Order No. 78-09789

Corrections to the ground state hyperfine structure of relative order sq alpha lambda n alpha/-1 in positronium and relative order (m sub e/M sub mu) sq alpha lambda N alpha/-1 in muonium due to the exchange of virtual photons are calculated. Contributions arising from the Coulomb potential, from the exchange of one transverse photon along with any number of ladder-Coulomb photons, and from the two transverse photon and crossed Coulomb photon exchanges are discussed. In treating the single transverse photon-multiple Coulomb photon exchanges, the contributions involving different numbers of Coulomb photons are added and the resulting expression is expanded in terms of a quantity that is inherently smaller than the Coulomb potential in the non-relativistic region. This procedure permits considering from the beginning, important cancellations that occur between the various terms in an expansion in powers of the Coulomb potential. Dissert. Abstr.

N78-29888 California Univ., Los Angeles.
PHENOMENOLOGY OF NEUTRAL CURRENT INTERACTIONS Ph.D. Thesis
Pham Quang Hung 1978 343 p
Avail: Univ. Microfilms Order No. 78-11354

Experiments are proposed for determining completely the spacetime and isospin (or quark quantum number) properties of the hadronic part of weak neutral currents. Predictions for various models are presented. Simultaneous analyses of inclusive and semi-inclusive reactions in neutrino-nucleon collisions and elastic neutrino-proton scattering determine the neutral-current couplings between neutrinos and hadrons up to a two-fold vector-axial-vector ambiguity. One of the preferred solutions coincides with the Salam-Weinberg model within errors while the other solution, also compatible with SU(2) x U(1) models with the simplest Higgs mechanism, may be helpful in understanding the Bismuth puzzle. Weak boson models with a single neutral Z boson must satisfy six factorization relations that can be tested in forthcoming experiments. Dissert. Abstr.

N78-29889 Illinois Univ. at Urbana-Champaign, Urbana.
BACKWARD RESONANCE PRODUCTION IN PI MINUS PLUS PROTON GOES TO NEUTRON PI PLUS PI MINUS 8 GeVc Ph.D. Thesis
Robert Gene Wagner 1978 104 p
Avail: Univ. Microfilms Order No. 78-11305

An 8 GeV/C negative pion beam focused on a liquid hydrogen target inside a streamer chamber was used to study the interaction negative pion positive proton goes to neutron positive pion negative ion. The neutron was produced fast and forward in the laboratory. The chamber was triggered on the interaction of a fast, forward neutral hadron in thick plate optical spark chambers. A total of 866 events had an acceptable 3 constraint fit to negative pion positive proton goes to neutron positive pion negative pion and satisfied other selection criteria. The data were characterized by backward production of resonant final states. Differential cross sections and decay angular distributions for these states are presented and implications for the production mechanisms are discussed. Dissert. Abstr.

N78-29890 Iowa Univ., Iowa City.
A MOLECULAR DYNAMICS STUDY OF A SYSTEM OF HARD SPHEROCYLINDERS Ph.D. Thesis
Dennis Wayne Rebertus 1977 165 p
Avail: Univ. Microfilms Order No. 78-10378

A molecular dynamics study of three systems of hard spherocylinders was made. From the positions and velocities recorded at each time step in the numerical integration of the equations of motion, the pressure, orientational order, velocity autocorrelation functions, and orientational correlation functions were computed. The equation of state, determined by averaging the virial, agreed remarkably well with the scaled particle theory and with a previous Monte Carlo study. Some of the velocity autocorrelation functions exhibited the long-time tails predicted by hydrodynamic and kinetic theory. The diffusion constants derived from the velocity correlation functions were compared with those from Boltzmann and Enskog theory. The orientational correlation functions were compared with those predicted by certain stochastic models of diffusion. No single model fit the correlation functions for every system. Dissert. Abstr.

N78-29891 Minnesota Univ., Minneapolis.
COLLISIONAL STABILIZATION OF CHEMICALLY ACTIVATED MOLECULES Ph.D. Thesis
Richard James McCluskey 1977 172 p
Avail: Univ. Microfilms Order No. 7809700

The kinetics of alkylcycloalkanes, activated by methylene radical reactions to energies at least 40 kcal/mole above their decomposition or isomerization thresholds, investigated at low pressures in the presence of large, polyatomic bath gases. The ratio of decomposition to stabilization rate, D/S, was measured for each activated molecule as a function of bimolecular collision frequency. Reactions were performed at pressures sufficiently low for the D/S ratio to exceed at least 12 with each molecule and generally to be greater than 30. All data plots of D/S versus reciprocal collision frequency were concave upward, indicating multistep collisional deactivation. Using RRKM theory and a stepladder deactivation scheme the experimental data were adequately fit by computer models. Dissert. Abstr.

N78-29892# Maryland Univ., College Park. Inst. for Physical Science and Technology.
CALCULATION OF THE LASER INDUCED STARK SHIFTS IN DIATOMIC MOLECULES Final Report, 1 Sep. 1975 - 30 Sep. 1976
Robert W. Gammon Dec. 1977 42 p refs
(Contract F44620-76-C-0033)
(AD-A053637; AFOSR-78-0746TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

Standard perturbation results are applied to the case of laser induced dynamic Stark shifts of vibration-rotation terms of diatomic molecules. For fields at frequencies near an allowed vibration-rotation transition there are just four terms coupled by allowed transitions which cause significant shifts. After discussion of the method of calculating specific matrix elements from rotationless Einstein A coefficients, examples are of Stark shift predictions for terms of HF, DF and CO involved in strong laser lines of these molecules. Author (GRA)

N78-29893# Naval Research Lab., Washington, D. C.
A NEW COLLECTIVE PARTICLE ACCELERATOR Interim Report
Moshe Friedman Feb. 1978 11 p refs
(RR0110941)
(AD-A053759; NRL-MR-3724) Avail: NTIS HC A02/MF A01 CSCL 20/7

A simple and novel mechanism for a collective particle accelerator is proposed. It is suggested that a density modulated intense relativistic electron beam propagating in a spatially modulated magnetic field can drag particles (electrons or ions) and accelerate them to high energies. This new mechanism can generate high particle current. A strong radial electric field exists in the mechanism ensuring radial confinement of the accelerated ions. Author (GRA)

N78-29894# IBM Watson Research Center, Yorktown Heights, N.Y.
SELECTION RULE EFFECTS IN ELECTRONIC EXCITATIONS OF CHEMISORBED MOLECULES AS STUDIED BY ENERGY LOSS SPECTROSCOPY
G. W. Rubloff 5 Jan. 1978 14 p refs
(Contract N00014-77-C-0366; NR Proj. 056-651)
(AD-A054105; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/8

Selection rule effects associated with long-range transition dipole scattering can be significant in electron energy loss spectroscopy (ELS) for loss energies up to approx. 10-12 eV (or higher) on a variety of metal and semiconductor surfaces. These effects will appear in ELS studies of the electronic excitations of chemisorbed molecules; in particular, selection rule effects will suppress the intensity of certain low-lying valence transitions in several cases of current interest in chemisorption. Author (GRA)

N78-29895# Brookhaven National Lab., Upton, N. Y.
PLASMA NEUTRALIZER FOR H(-)BEAMS
M. W. Grossman 1977 6 p refs Presented at Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N. Y., 26 Sep. 1977
(Contract EY-76-C-02-0016)
(BNL-23650; Conf-770940-20) Avail: NTIS HC A02/MF A01

Neutralization of H(-) beams by a hydrogen plasma is discussed. Optimum target thickness and maximum neutralization efficiency as a function of the fraction of the hydrogen target gas ionized is calculated for different H(-) beam energies. Also, the variation of neutralization efficiency with respect to target thickness for different H(-) beam energies is computed. The dispersion of the neutralized beam by a magnetic field for different energies and different values of B . z is found. Finally, a type of plasma jet is proposed, which may be suitable for a compact H(-) neutralizer. ERA

N78-29896# Brookhaven National Lab., Upton, N. Y.
NEUTRALIZATION OF H(-) BEAMS WITH GAS JETS
Calvin K. Lam 1977 4 p refs Presented at the Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N. Y., 26 Sep. 1977
(Contract EY-76-C-02-0016)
(BNL-23648; Conf-770940-24) Avail: NTIS HC A02/MF A01

A test facility was constructed to created a compact curtainshaped gas jet as a first-generation operational neutralizer for the 150 keV H(-) beam. Different gases and vapors were considered, their optimum target thicknesses and neutralization efficiencies with respect to beam energies were explored. Two techniques of gas jet formation were compared. Multiparallel-channel effusive jets of CO2 and H2 were selected as test candidates. ERA

N78-29897# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF H(-) SOURCES AT BROOKHAVEN NATIONAL LABORATORY
K. Prelec 1977 7 p refs Presented at the Symp. on the Production and Neutralization of Negative Ions and Beams, Upton, N. Y., 26 Sep. 1977
(Contract EY-76-C-02-0016)
(BNL-23651; Conf-770940-19) Avail: NTIS HC A02/MF A01

Negative hydrogen ion sources were developed, with the initial goal to design a source for accelerator applications and later on to design a large unit for applications in neutral beam injectors of magnetic fusion devices. Three types of sources were investigated, a hollow discharge duoplasmatron yielding H(-) currents up to 60 mA, a Penning source yielding H(-) currents up to 440 mA, and a magnetron source yielding H(-) currents up to 1 A. All sources operate with a mixture of hydrogen gas and cesium vapors, and H(-) ions are most likely produced on cesium covered electrode surfaces. A larger model of a Penning/magnetron source was constructed and will be tested soon; it incorporates among other new features a system for the cooling of the cathode. ERA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N78-29898# Brookhaven National Lab., Upton, N. Y.
LINEAR ACCELERATOR DRIVEN (LADR) AND REGENERATIVE REACTORS (LARR) FOR NUCLEAR NON-PROLIFERATION
Meyer Steinberg, H. Takahashi, J. R. Powell, and H. J. C. Kouts Sep. 1977 15 p refs
(Contract EY-76-C-02-0016)
(BNL-50731) Avail: NTIS HC A02/MF A01

Linear accelerator breeders (LAB) could be used to produce fissile fuel in two modes, either with fuel reprocessing or without fuel reprocessing. With fuel reprocessing, the fissile would be separated from the target and refabricated into a fuel element for use in a burner power reactor. Without reprocessing, the fissile material would be produced in-situ, either in a fresh fuel element or in a depleted or burned element after use in a power reactor. In the latter mode the fissile material would be increased

in concentration for reuse in a power reactor. This system is called a Linear Accelerator Regenerative Reactor (LARR). The LAB can also be conceived of operating in a power production mode in which the spallation neutrons would be used to drive a subcritical assembly to produce power. This is called a Linear Accelerator Driven Reactor (LADR). A discussion is given of the principles and some of the technical problems of both types of accelerator breeders. ERA

74 OPTICS

Includes light phenomena.

N78-29899 Arizona Univ., Tucson.
OPTICAL DESIGN OF A COHERENT OPTICAL PROCESSOR Ph.D. Thesis
William Henry Swantner 1978 117 p
Avail: Univ. Microfilms Order No. 7811510

The design and evaluation of lenses for some coherent optical processing applications are discussed. The first order properties are depicted by diagrams of lenses with paraxial ray paths through the system. Object-pupil relationships are shown. A methodology to treat the diffraction integrals of processors is developed. In the geometrical optics description of a Fourier Transform Lens (FTL), it is shown that the diffracting object defines the location and the extent of the len's aperture stop. A matched filter correlator constructed from two FTL's of different focal lengths was designed and evaluated. The fabrication data for the lenses and pupil and focal plane location are stated. The design approach and a description of the defect function for minimization of abbreviations are given. A design scheme for lenses using the capability of ACCOS 5 for zoom lens optimazation is demonstrated. Dissert. Abstr.

N78-29900 Alabama Univ., University.
PRIMARY ABERRATIONS FOR GRAZING INCIDENCE Ph.D. Thesis
Carl Emil Winkler 1977 74 p
Avail: Univ. Microfilms Order No. 780886

A complete set of primary aberrations was developed, and its applicability to the design and optimization of grazing incidence systems as well as its limitations is discussed. A concise and simple condition for zero spherical aberration and a relation showing that field curvature is predominantly responsible for the off-axis image degradation are regarded the outstanding results of theis study. It is also shown that to the intended accuracy of this theory, a two element system displaying no spherical abberration is also free of coma. This is in good agreement with the fact that grazing incidence telescopes, when free of spherical aberration, are known to be very nearly aplanatic. A comparison of the findings with raytrace results of a grazing incidence X-ray telescope design is included. Dissert. Abstr.

N78-29901 Texas Technological Univ., Lubbock.
SPACE-VARIANT COHERENT OPTICAL PROCESSING Ph.D. Thesis
Robert Jackson Marks, II 1977 218 p
Avail: Univ. Microfilms Order No. 7810844

Various techniques are described for performing linear space-variant operations with coherent optical processors. General linear system theory is developed for application to processor design. The continuum orthonormal basis set response system characterization, of which the conventional superposition integral is a special case, is modeled by three implementable approximations displaying contrasting properties. The piecewise isoplanatic approximation, in which the parent space-variant system is approximated by a number of space-invariant systems, is essentially independent of the input. The discrete orthonormal basis set response characterization, in which the system is defined by its responses to elements of an orthonormal basis set, is essentially system independent. A number of sampling theorems applicable to certain classes of space-variant systems are also presented. Dissert. Abstr.

N78-29902*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF FORMING A SHARP EDGE ON AN OPTICAL DEVICE Patent Application
George J. Bergen, inventor (to NASA) Filed 28 Jul. 1978 21 p
(NASA-Case-GSC-12348-1; US-Patent-Appl-SN-929088) Avail: NTIS HC A02/MF A01 CSCL 20F

An edge having a sharpness of less than 2 and preferably about 0.3 micron can be formed on a wedge shaped piece of optical material in a relatively short period of time without breaking the edge, peeling the optical material away from the edge, or forming an uneven edge. The technique described involves placing the optical device in a holding mechanism and grinding one surface until it is so-planar with the surface of the holding mechanism. The surfaces of both the optical device and the holding mechanism are then polished with felt until the optical surface adjacent to the holder has an edge of sharpness of less than 2 micron. Optical materials formed in this manner will be used as beam splitters in the ultraviolet spectrapolarimeter to be flown on the Solar Maximum Mission. NASA

N78-29903# Laser Diode Labs., Inc., Metuchen, N. J.
LIGHT EMITTING DIODES FOR FIBER OPTIC COMMUNICATIONS Quarterly Report, 1 Jul. - 30 Sep. 1977
Albert Gennaro 20 Dec. 1977 37 p
(Contract DAAB07-76-C8135)
(AD-A053657; QR-4) Avail: NTIS HC A03/MF A01 CSCL 17/2

The design and fabrication of high speed etched-well light emitting diodes for fiber optic communications is discussed with regard to materials synthesis via LPE, wafer fabrication, and device assembly in a manufacturing environment. Author (GRA)

N78-29904# School of Aerospace Medicine, Brooks AFB, Tex.
IMPACT VULNERABILITY OF SCRATCHED GLASS LENSES Final Report, Apr. - Sep. 1977
Benjamin Kislin, Robert E. Swarm, J. W. Miller, and Joseph R. Fischer Dec. 1977 18 p refs
(AD-A053421; SAM-TR-77-33) Avail: NTIS HC A02/MF A01 CSCL 11/2

Ophthalmic glass lenses of dress thickness were diamond scribed on their convex surfaces after heat or chemical tempering to a significant penetration of their compression layer. Nontempered lenses were similarly scratched. All were subjected to dropball impacts to examine whether the damaged tempered lenses would be more vulnerable to breakage than the scribed lenses that were not under internal stress. The results showed that the nontempered lenses had less impact resistance than the tempered. No significant difference in impact resistance was seen between the chemical- and heat-tempered groups.
Author (GRA)

N78-29905# Naval Research Lab., Washington, D. C.
POSSIBLE NEW IRDOME MATERIALS FOR TRANSMISSION TO 4.5 - 5 MICROMETERS Interim Report
Roy W. Rice Feb. 1978 20 p refs
(ZF54595001)
(AD-A053732; NRL-MR-3725) Avail: NTIS HC A02/MF A01 CSCL 17/5

Results of a preliminary survey of possible new IR materials for use out to 4.5-5 micrometers is reported. While some tentative candidate materials are identified, the primary purpose of this report is to demonstrate that ternary and higher compounds provide a significant opportunity for providing improved IR materials over the typical list of known diatomic candidates. Since the pacing need for many new IR systems is thermal shock resistance, emphasis has been given to the possibility of finding materials with low thermal expansion coefficients.
Author (GRA)

N78-29906# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ANALYSIS OF THE OPTICAL MEMORY AND TRANSDUCER REQUIREMENTS FOR THE OMFIC SYSTEM APPLIED TO GUIDED PROJECTILES
Kenneth G. Leib and M. Ronald Wohlers Feb. 1978 73 p refs
(AD-A054706; RE-554) Avail: NTIS HC A04/MF A01 CSCL 19/1

The Optical Matched Filter Image Correlator (OMFIC) can identify targets and their number, and provide information about their bearing, positional coordinates, range interval, and velocity. Thus, it provides a new concept for the missile or projectile guidance application. The optical memory size and real time transducer update requirements are two of the most important aspects of the OMFIC system when used for guiding a projectile. An analysis of these factors shows that the memory bank requirements are manageable and within current technology capabilities. In order to cover the range from acquisition (1.5 km) to approximately 50 meters from impact only 397 memory positions are required for highly discriminating matched filters. The transducer update rate can be set at television frame rates for guidance to 50 meters from impact at approximately M sub f = 0.5. Other aspects of the OMFIC memory bank and transducer requirements for missile/projectile guidance are developed in the report. GRA

N78-29907# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTROOPTICAL DEVICES Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1977
Ivars Melngailis and Arthur G. Foyt, Jr. 30 Sep. 1977 27 p refs
(Contract F19628-76-C-0007; AF Proj. 2611)
(AD-A054477; ESD-TR-78-28) Avail: NTIS HC A03/MF A01 CSCL 20/6

Considerable progress has been made toward the achievement of the current objectives of the electrooptical device program. These goals are: (1) to perform life tests on GaInAsP/InP double-heterostructure (DH) diode lasers operating in the 1.0 to 1.3 micron wavelength region and analyze the degradation mechanisms, and (2) to fabricate and study avalanche photodiodes of similar composition GaInAsP operating in the same wavelength region. Life tests of CW, room-temperature GaInAsP/InP DH lasers have continued with a total of 13 devices examined in some detail. Eleven of the lasers have operated for over 2000 hours, with the longest-lived operating 7700 hours before failure. End-face contamination problems have apparently been reduced and other mechanisms for degradation, both of external and internal nature, are under study. CW operation of the DH GaInAsP/InP lasers has been demonstrated at temperatures up to 50 C. The pulsed threshold was found to increase with temperature as Jth = jo exp (T/To) with to approx 75 C and Jo a constant. Over the temperature range 10 C - T - 50 C, the temperature dependence of the wavelength was approximately linear with delta Lambda/delta T approx 3.2 A/C. The pulse response and modulation characteristics of GaInAsP/InP lasers have also been investigated. Clean output pulses with restimates of less than 250 psec, pulse modulation at 200 megapulses/sec, and pulse-position modulation at a 100-Mbit/sec rate have been achieved. Modulation rates in the GHz range should be attainable. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-29908 Iowa Univ., Iowa City.
OBSERVATIONS PERTAINING TO THE DYNAMICS OF THE PLASMA SHEET Ph.D. Thesis
Richard Joseph Decoster, II 1977 111 p
Avail: Univ. Microfilms Order No. 78010338

Plasmas on the surface of the plasma sheet at its interface with the high-latitude tail are studied at approximately 30 to 40 earth radii in the tail of the earth's magnetosphere with LEPEDEA plasma instrumentation on board the earth-orbiting IMP-7 and IMP-8 satellites. Protons at this interface are frequently found to be flowing towards earth with large velocities greater than 400 km(sec)-1. Velocities measured on the plasma sheet's surface average greater than those measurements at random locations within the plasma sheet. Ten of the twenty cases studied exhibit plasma sheet cooling subsequent to the encounter. Characteristic anisotropic proton velocity distributions are commonly measured for the earthward jetting plasma. A three-parameter model is presented that explains these observed distributions and that places a field aligned acceleration region well tailward of the spacecraft. Dissert. Abstr.

N78-29909 Wisconsin Univ. - Madison.
THE DISSIPATIVE TRAPPED ELECTRON INSTABILITY IN THE LINEAR MULTI-MIRROR DEVICE Ph.D. Thesis
David Paul Grubb 1978 254 p
Avail: Univ. Microfilms Order No. 7806423

A dispersion relation for the dissipative trapped electron mode (DTEM) was derived which includes the physics relevant to the description of the plasma in the Linear Multi-Mirror. This dispersion relation accurately predicts the behavior of two instabilities, the first of which dominates in the plasma at high magnetic field strength and is localized radially in a region of coinciding density and electron temperature gradients. The second instability dominates in the plasma at low magnetic field strength and is localized radially in a region of relatively weak electron temperature gradient. These modes are identified as trapped electron instabilities: the first driven by the electron temperature gradient, the second driven by finite ion Larmor radius effects. Dissert. Abstr.

N78-29910 Texas Technological Univ., Lubbock.
PLASMA-LASER INTERACTIONS WITH SOLID POLYSTYRENE MICROSPHERES Ph.D. Thesis
David Lewis Smith 1977 107 p
Avail: Univ. Microfilms Order No. 7810853

Qualitative agreement with theoretical scaling laws was obtained. The pellet surfaces acquired a fine polish when exposed to a plasma as indicated by electron microscopy. Comparison of the ionization intensities in the ablating neutral material through the first four carbon lines indicated pellet cloud temperatures in the range of 5 eV. Both spectroscopy and streak camera photography showed that focusing a Q-switched ruby laser on the pellet during the plasma interaction produced a marked increase in the ionization intensities that was sustained long after the laser pulse. The pellet-plasma interaction alone was determined to be an inefficient means of generating X-rays. The combination pellet-plasma-laser interaction promises to be a feasible radiation source for durations much longer than those produced with only the laser solid system. Dissert. Abstr.

N78-29911*# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.
MONTE CARLO SIMULATION OF THE CLASSICAL TWO-DIMENSIONAL ONE COMPONENT PLASMA
R. C. Gann, Sudip Chakravarty, and G. V. Chester [1978] 56 p refs
(Grant NGR-33-010-188; NSF DMR-76-81083)
(NASA-CR-157467; TR-3074) Avail: NTIS HC A04/MF A01 CSCL 20I

Monte Carlo simulation, lattice dynamics in the harmonic approximation, and solution of the hypernetted chain equation were used to study the classical two-dimensional one component plasma. The system consists of a single species of charged particles immersed in a uniform neutralizing background. The particles interact via a l/r potential, where r is the two dimensional separation. Equations of state were calculated for both the liquid and solid phases. Results of calculation of the thermodynamic functions and one and two particle correlation functions are presented. A.R.H.

N78-29912# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A HEATING MECHANISM OF IONS DUE TO LARGE AMPLITUDE COHERENT ION ACOUSTIC WAVE
Nobuo Yajima, Yoshinobu Kawai, and Ken Kogiso May 1978 31 p refs
(IPPJ-333) Avail: NTIS HC A03/MF A01

The ion heating mechanism in a plasma with a coherent ion acoustic wave was studied experimentally and numerically. Ions are accelerated periodically in the electrostatic potential of the coherent wave and their oscillation energy is converted into the thermal energy of ions through the collision with the neutral atoms in plasma. The Monte Carlo calculation is applied to obtain the ion temperature. The amplitude of the electrostatic potential, the mean number of collisions and the mean life time of ions are treated as parameters in the calculation. The numerical results are compared with the experiments and are in good

agreement. The ion temperature is found to increase as the amplitude of the coherent wave increases. The high energy tail in the distribution function of ions are observed for the case of large wave-amplitude. A.R.H.

N78-29913# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANOMALOUS ION LOSS BY LOW FREQUENCY INSTABILITIES
Sanae Inoue Jun. 1978 11 p refs
(IPPJ-334) Avail: NTIS HC A02/MF A01

The ambipolarity formula for the cross-field flux of the nonuniform plasma in the presence of the low frequency electromagnetic fluctuations is presented. Because of the ion polarization drift, the ions are pulled out by the diffusing electrons so that the ambipolarity of the flux is maintained independent of the finite ion Larmor radius effect. A.R.H.

N78-29914# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HIGH-PRESSURE EQUILIBRIA OF A SMALL-ASPECT-RATIO TOKAMAK
K. Yamazaki and T. Uchida Jun. 1978 19 p refs
(IPPJ-335) Avail: NTIS HC A02/MF A01

Axisymmetric sharp-boundary toroidal equilibria with high pressure are investigated to the second order in the inverse aspect ratio expansion. The second order effects of anisotropic plasma pressure and toroidal mass flow on toroidal equilibria are also analyzed with the quasi-uniform current model. Author

N78-29915# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RADIATION PHENOMENA OF PLASMA WAVES. PART 1: FUNDAMENTAL RADIATION THEORY
Toshiro Ohnuma Jun. 1978 43 p refs
(IPPJ-336-Pt-1) Avail: NTIS HC A03/MF A01

Fundamental radiation theory is examined and both theoretical and experimental investigations of radiation properties in plasmas are reviewed. Experiments on radiation from point sources are discussed with simplified theoretical considerations. Experiments on radiation from finite sources include summarized theoretical results. A.R.H.

N78-29916*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
SYSTEM ANALYSIS OF PLASMA CENTRIFUGES AND SPUTTERING Final Report, 1 Nov. 1976 - 31 Oct. 1977
S. H. Hong May 1978 141 p refs
(Grant NGR-06-002-147)
(NASA-CR-135079) Avail: NTIS HC A07/MF A01 CSCL 20I

System analyses of cylindrical plasma centrifuges are presented, for which the velocity field and electromagnetic fields are calculated. The effects of different electrode geometrics, induced magnetic fields, Hall-effect, and secondary flows are discussed. It is shown that speeds of 10000 m/sec can be achieved in plasma centrifuges, and that an efficient separation of U238 and U235 in uranium plasmas is feasible. The external boundary-value problem for the deposition of sputtering products is reduced to a Fredholm integral equation, which is solved analytically by means of the method of successive approximations. Author

N78-29917# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTRODUCTION TO THE KINETIC THEORY OF PLASMA TURBULENCE [INTRODUCAO A TEORIA CINETICA DE TURBULENCIA EM PLASMAS]
Gerson Otto Ludwig Feb. 1978 38 p refs In PORTUGUESE
(INPE-1196-PE/112) Avail: NTIS HC A03/MF A01

Various aspects in the theory of turbulence in collisionless plasmas were studied. Nonlinear theory was used to describe low turbulence plasmas which intially develop from a form that extends to the theory of strong turbulence plasmas. This extension utilizes the concept of orbit perturbations in the turbulent boundary layer. Transl. by B.B.

N78-29918# Naval Research Lab., Washington, D. C.
A GENERAL TWO-DIMENSIONAL TOKAMAK MODEL Interim Report
Mark Emery, John Garder, Martin Fritts, Jay Boris, and Niels Winsor Mar. 1978 25 p refs
(Contract E(49-20)-1006)
(AD-A054413; NRL-MR-3744) Avail: NTIS HC A02/MF A01 CSCL 18/1

A two dimensional dynamic transport code has been developed. It assumes axisymmetry, but it is capable of modeling multiple magnetic axes, divertors and other complex geometries. A triangular mesh allows detailed analysis of separatrices, divertors and regions unstable to trapped-particle and ballooning modes. Author (GRA)

N78-29919# Los Alamos Scientific Lab., N. Mex.
GAC-ANL TNS SCOPING STUDIES. VOLUME 11: TNS DOUBLET TOKAMAK OHMIC-HEATING POWER SUPPLY STUDY Status Report, 1 Oct. 1976 - 30 Sep. 1977
Dec. 1977 122 p refs
(Contracts EY-76-C-03-0167-038; W-7405-eng-36; GA Proj. 3235; LA Proj. E-736)
(GA-A-14614-Vol-11; LA-7053-MS-Vol-11) Avail: NTIS HC A06/MF A01

The feasibility of a homopolar machine as an energy transfer and storage element in the circuit of the TNS doublet was investigated, related switching problems, and to the nature of the plasma showdown at the end of the burn cycle is considered. A minimal conceptual engineering analysis of an air core superconducting field coil excited homopolar machine is presented as well as a comparative design of an iron dominated homopolar machine. Approximate costs are developed for both homopolar machines. In particular, a variable capacitance homopolar machine with superconducting field coils was considered. ERA

N78-29920# General Atomic Co., San Diego, Calif.
LOWER HYBRID WAVE HEATING EXPERIMENTS AT GENERAL ATOMIC
Charles P. Moeller Dec. 1977 5 p Presented at the 3d Topical Conf. on Radio Freq. Plasma Heating, Pasadena, Calif., 11-13 Jan. 1978
(Contract EY-76-C-03-0167-038)
(GA-A-14810; Conf-780113-6) Avail: NTIS HC A02/MF A01

Plasma heating experiments utilizing Landau damping of the lower hybrid wave at frequencies above omega/sub LH/ were done in Doublet IIA and the dc Octopole Tokamak. Both the Octopole and Doublet IIA demonstrated excellent coupling using slow wave antennas. The dc Octopole operating in this normal mode showed penetration and highly efficient electron heating. Increased electrical conductivity was observed in the Doublet IIA experiments. In the current experiments the auxiliary power can significantly exceed the ohmic power input, the ratio being as high as 5. ERA

N78-29921# General Atomic Co., San Diego, Calif.
EFFECT OF LOWER HYBRID WAVES ON THE EVOLUTION OF THE DOUBLET 2A PLASMA
D. F. Vaslow, Neil H. Brooks, R. L. Freeman, E. J. Heckman, T. H. Jensen, John Lohr, J. L. Luxon, Ali Mahdavi, Charles P. Moeller, John C. Riordan et al 1978 6 p refs Presented at the 3d Topical Conf. on Radio Freq. Plasma Heating, Pasadena, Calif., 11-13 Jan. 1978
(Contract EY-77-C-03-0167-038)
(GA-A-14809) Avail: NTIS HC A02/MF A01

Radio frequency (RF) power at 800 MHz and 915 MHz was launched into Doublet IIA plasmas using slow wave antennas. The maximum rf power coupled is more than a factor of four larger than the ohmic power for circular discharges. Changes in the plasma current and loop voltage were observed with the onset of RF power for low impurity level discharges. ERA

N78-29922# General Atomic Co., San Diego, Calif.
COUPLING OF LOWER HYBRID WAVES IN THE DOUBLET 2A HIGH POWER RF HEATING EXPERIMENTS
V. S. Chan, Charles P. Moelier, and R. W. Gould Dec. 1977 7 p refs Presented at the 3d Topical Conf. on Radio Freq. Plasma Heating, Pasadena, Calif., 11-13 Jan. 1978
(Contract EY-76-C-03-0167-038)
(GA-A-14808; Conf-780113-5) Avail: NTIS HC A02/MF A01

In the Doublet IIA high power rf heating experiments, a slow wave is launched by an electrostatic antenna above the lower hybrid frequency. A total of six structures with n/sub parallel/from 11 to 16 at 800 and 915 MHz at power up to

100 kW/structure are used. The coupling and radiated spectrum are analyzed are analyzed using the theory developed for these antennas. They are found to be insensitive to changes in plasma parameters. ERA

N78-29923# General Atomic Co., San Diego, Calif.
LIMITATIONS ON LOWER HYBRID HEATING OF DENSE, HOT PLASMAS
R. W. Harvey, J. M. Rawls, M. P. Hacker, and V. S. Chan Dec. 1977 5 p refs Presented at the 3d Topical Conf. on Radio Freq. Plasma Heating, Pasadena, Calif., 11-13 Jan. 1978
(Contract EY-76-C-0167-038; GA Proj. 3235)
(GA-A-14783; Conf-780113-2) Avail: NTIS HC A02/MF A01

Accessiblity and quasilinear Landau damping considerations limit the density and temperature of plasma which may be effectively heated by lower hybrid (LH) waves. In conjunction with a global thermonuclear ignition condition, it found that LH heating to ignition is possible if the plasma size and magnetic field satisfy aB squared greater than or approximately equal to 70 (meters-tesla squared.) ERA

N78-29924# Blalock (S. D., Jr.), Kingsport, Tenn.
STRUCTURE OF MAGNETIC FIELD PERTURBATIONS DURING THE DEVELOPMENT OF UNSTEADY SEPARATION IN THE TOKAMAK-6 INSTALLATION
V. G. Merezhkin 1977 29 p refs Transl. into ENGLISH of the Russian report from the Institute of Atomic Energy, Moscow, 1977 p 1-29 Sponsored by DOE Prepared for ORNL
(ORNL-TR-4528) Avail: NTIS HC A03/MF A01

A detailed investigation was made of the structure of helical perturbations and their development dynamics in the separation process. Both theory and experiment are described. ERA

N78-29925# California Univ., Livermore. Lawrence Livermore Lab.
TOMOGRAPHY OF LASER FUSION PLASMAS
N. M. Ceglio 2 Aug. 1977 21 p refs Presented at the 8th Intern. Conf. on X-ray Optics and Microanalysis, Boston, 18-24 Aug. 1977
(Contract W-7405-eng-48)
(UCRL-79291; Conf-770849-4) Avail: NTIS HC A03/MF A01

A particular coded imaging technique, Zone Plate Coded Imaging (ZPCI), was successfully used for X-ray and particle microscopy of laser fusion plasmas. ZPCI is highly attractive for investigating laser produced plasma because it possesses a tomographic capability not shared by either the GIR or pinhole imaging techniques. This presentation provides a brief discussion of the tomographic potential of ZPCI. In addition, the first tomographic X-ray images of a laser produced plasma are presented. ERA

N78-29926# Oak Ridge National Lab., Tenn.
RIPPLE BUNDLE DIVERTOR FOR TOKAMAKS
J. Sheffield and R. A. Dory Mar. 1978 17 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6220) Avail: NTIS HC A02/MF A01

The bundle divertor, designed for density and impurity control, has been successfully applied on the DITE Tokamak. In this application it is subject to high stresses and is restricted to short pulses and low toroidal fields. A new version is made possible by fitting the vacuum vessel close to the toroidal coils. This allows the plasma to exist in the outer regions of higher toroidal field ripple. This ripple bundle divertor should operate at lower stresses and for longer pulses at higher magnetic fields. ERA

N78-29927# Los Alamos Scientific Lab., N. Mex.
SECOND TOPICAL CONFERENCE ON HIGH-TEMPERATURE PLASMA DIAGNOSTICS
Franz C. Jahoda, comp. and Kenneth B. Freese, comp. Feb. 1978 117 p refs Conf. held at Santa Fe, N. Mex., 1-3 Mar. 1978; sponsored by Am. Phys. Soc.
(Contract W-7405-eng-36)
(LA-7160C; Conf-780318-Absts) Avail: NTIS HC A06/MF A01

The program and abstracts of papers presented at the Second American Physical Society Topical Conference on High Temperature Plasma Diagnostics are presented. ERA

N78-29928# Los Alamos Scientific Lab., N. Mex.
MICROWAVE ABSORPTION STUDIES NEAR THE PLASMA FREQUENCY
B. L. Wright, M. E. Banton, H. Dreicer, and J. C. Ingraham 1978 5 p refs Presented at the 3d Conf. on RF Plasma Heating, Pasadena, Calif., 11-13 Jan. 1978
(Contract W-7405-eng-36)
(LA-UR-78-51; Conf-780113-7) Avail: NTIS HC A02/MF A01

To study the rate of electromagnetic wave absorption by a plasma, two high-Q microwave resonators are used that surround an alkali plasma column. The resonators are operated in the TM sub 010 mode (rf electric field parallel to static magnetic field) at resonant frequencies omega/2 pi, near 2.0 GHz. The fully ionized plasma is in thermal equilibrium, T/sub e/ = T/sub i/ = 0.2 eV, with a density that can be varied to obtain values of omega/sub p//omega near unity. The rf absorption rate is measured by first resonantly exciting a mode with a short pulse of microwave power and then monitoring the decay of its rf field energy after the external source is switched off. After correction for loss in the copper resonator walls, the observed decay rate can be converted to an absolute rate of microwave absorption by the plasma alone or to an equivalent value of its ac electrical resistivity. ERA

N78-29929# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
CURRENT-DRIVEN TURBULENCE IN PLASMAS
H. deKluiver Oct. 1977 104 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-77-106) Avail: NTIS HC A06/MF A01

Research on plasma heating in linear and toroidal systems using current-driven turbulence is reviewed. The motivation for this research is presented. Relations between parameters describing the turbulent plasma state and macroscopic observables are given. Several linear and toroidal devices used in current-driven turbulence studies are described, followed by a discussion of special diagnostic methods used. Experimental results on the measurement of electron and ion heating, anomalous plasma conductivity, and associated turbulent fluctuation spectra are reviewed. Theories on current-driven turbulence are discussed and compared with experiments. It is demonstrated from the experimental results that current-driven turbulence occurs not only for extreme values of the electric field but also for an experimentally much more accessible and wide range of parameters. This forms a basis for a discussion on possible future applications in fusion-oriented plasma research. Author (ESA)

N78-29930# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
CURRENT AND NEUTRON YIELD SCALING OF FAST HIGH VOLTAGE PLASMA FOCUS
G. Decker, L. Flemming, H. J. Kaeppeler, T. Oppenlaender, G. Pross, P. Schilling, H. Schmidt, M. Shakhatre, and M. Trunk 1977 38 p refs Submitted for publication
(IPF-77-2) Avail: NTIS HC A03/MF A01

Numerical and experimental studies were made concerning an increase of the effective discharge current for the plasma focus from a bank of constant energy. From the higher discharge current an increased neutron yield is expected. An 85 kV/12 kJ device with a current rise time of 600 ns was investigated experimentally. The obtained neutron yield was larger by a factor of 3 compared to devices of equal energy but low voltage. The geometrical and pressure variations, necessary for optimization, are discussed. Using MHD calculations and impedance considerations, various banks, including those with high voltage and low inductance, were compared with respect to plasma data and discharge current. Author (ESA)

N78-29931# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
BEAM DEVIATION METHOD AS A DIAGNOSTIC TOOL FOR THE PLASMA FOCUS
H. Schmidt and B. Rueckle 1978 29 p refs
(IPF-78-3) Avail: NTIS HC A03/MF A01

The application of an optical method for density measurements in cylindrical plasmas is described. The angular deviation of a probing light beam sent through the plasma is proportional to

the maximum of the density in the plasma column. The deviation does not depend on the plasma dimensions; however, it is influenced to a certain degree by the density profile. The method is successfully applied to the investigation of a dense plasma focus with a time resolution of 2 ns and a spatial resolution (in axial direction) of 2 mm. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-29932 State Univ. of New York at Stony Brook.
CONCENTRATION SUSCEPTIBILITY AND THE PHASE DIAGRAM OF He3-He4 MIXTURES NEAR THE TRICRITICAL LINE Ph.D. Thesis
Frederick Hermann Wirth 1978 135 p
Avail: Univ. Microfilms Order No. 7804225

The variation of He-3 concentration with height is measured in tHe lower phase of He-3-he-4 .mixtures near the tricritical point (TCP), at pressures of 2.5, 9.9, and 16.7 atmospheres. The thermodynamics of He-3-He-4 mixtures and the scaling hypothesis are discussed. The relationship between the gravitationally induced concentration gradient and the concentration susceptibility is derived. Theoretical models are discussed. An attempt is made to understand the pressure dependence of the concentration susceptibility in the light of these models. Improved determinations of the scaling properties of these models near the TCP are briefly discussed. Dissert. Abstr.

N78-29933 California Inst. of Tech., Pasadena.
PART 1: A RECIRCULATING CHARGE-COUPLED DEVICE. PART 2: THE MERCURY SELENIDE ON N-SILICON SCHOTTKY BARRIER Ph.D. Thesis
Gene Alan Clough 1978 47 p
Avail: Univ. Microfilms Order No. 78-10780

Entrance and exit gates allow a signal to be admitted, recirculated a given number of times, and then examined. In this way a small device permits simulation of a very long shift register without passing the signal through input and output diffusions. An oscilloscope motion picture demonstrating degradation of an actual circulating signal was made. The performance of the device in simulating degradation of a signal by a very long shift register is well fit by a simple model based on transfer inefficiency. The electrical properties of the mercury selenide on n-type chemically-cleaned silicon Schottky barrier were studied. Barrier heights measured were 0.96 volts for the photoresponse technique and 0.90 volts for the current-voltage technique. These are the highest barriers yet reported on n-type silicon.
Dissert. Abstr.

N78-29934 Florida Univ., Gainesville.
NUCLEAR MAGNETISM OF SOLID HELIUM-THREE Ph.D. Thesis
Charles Valentine Britton 1977 79 p
Avail: Univ. Microfilms Order No. 7810929

Nuclear magnetism in solid He-3 was investigated through measurements of the exchange pressure in high magnetic fields and measurements of the magnetic susceptibility along the melting curve from 20 mK to temperatures approaching the ordering transition. The field dependence of the exchange pressure was accurately determined and the temperature dependence verified. From these measurements the value of the lowest order magnetic exchange parameter was determined with increased accuracy. The magnetic susceptibility was measured along the melting curve. For temperatures above 4 mK the behavior can be expressed in the Curie-Weiss form with theta = minus 3.7 mK. Below 4 mK however, the susceptibility rises abruptly to values approximately twice those of the Curie-Weiss law. Dissert. Abstr.

N78-29935 Alabama Univ., University.
THERMOLUMINESCENCE AND ELECTRON SPIN RESONANCE STUDIES OF IRRADIATED BIOLOGICAL SINGLE CRYSTALS Ph.D. Thesis
David Wayne Cooke 1977 113 p
Avail: Univ. Microfilms Order No. 78-09849

Single crystals of X-irradiated L-alanine; Cr3+ were studied between 90 and 300K by electron spin resonance and thermoluminescence (TL) techniques. Ultraviolet photobleaching of the Cr3+ electron tapes and L-alanine radical centers was also investigated. The results demonstrate that the X-ray generated radical centers can be destroyed by UV-induced electron transport activity, and this destruction follows first order kinetics. The transformation of the primary neutral radical species to a secondary radical in L-alanine was found not to be induced by intermolecular electron transport. Scintillation observed in the ferroclectric crystals triglycine sulfate (TGS), deuterated TGS, and TGS: L-alanine is discussed as well as that from the potent oncogen 3-hydroxyxanthine. A possible mechanism associated with the in-vivo production of N-oxides from the ubiquitous parent purines is discussed. Dissert. Abstr.

N78-29936 Brown Univ., Providence, R. I.
THE CHEMISORPTION OF CARBON MONOXIDE, CARBON DIOXIDE AND OXYGEN ON THE MO(100) SURFACE Ph.D. Thesis
Thomas Edward Felter 1977 191 p
Avail: Univ. Microfilms Order No. 78-09056

Low energy electron diffraction, auger electron spectroscopy, flash desorption, and work function measurement were used in the 150 to 2000 K temperature range to study CO, CO2, and O2 chemisorption on Mo(100). Measurements of the angular distribution and the total current of ions released by electron stimulated desorption were successfully incorporated without any modification of the LEED optics in order to permit direct correlation with standard techniques. All three gases adsorb dissociatively on the room temperature surface. At lower temperatures (150-200 K) CO and CO2 adsorb molecularly but O2 still dissociates. Mo O3 and Mo O2 readily desorb from oxygen-covered Mo(100). Studies of the clean Mo(100) surface show that a phase transition can be induced by lowering the temperature below 300 K. The transition is completely reversible and depends only on the temperature. Dissert. Abstr.

N78-29937 North Carolina Univ. at Chapel Hill.
NUCLEAR SPIN-LATTICE RELAXATION IN SMALL METALLIC PARTICLES Ph.D. Thesis
Emilio Santiago GangotenaGonzalez 1977 88 p
Avail: Univ. Microfilms Order No. 7810448

The radio of the nuclear spin-lattice relaxation time in small particles to that of the bulk was measured in various metals. Small particles, prepared by gas evaporation, of aluminum, lead and silver with average diameters of 220, 150 and 108A, respectively, were studied. The nuclear spin of Al is 5/2, the latter species have spin 1/2. A decrease of this ratio in Al27 and an increase in Pb207 and Ag109 was found. The results obtained for the spin 1/2 metals agree with the Kubo prediction of discrete electronic energy levels which will hamper the nuclear relaxation mechanism in small metallic particles. Apparently bulk interactions leading to broadening of the electronic levels are inefficient in spin 1/2 small metal particles. Dissert. Abstr.

N78-29938 Michigan State Univ., East Lansing.
RAMAN SCATTERING FROM TWO-PHONON EXCITATIONS AND FROM ELECTRONIC NITROGEN IMPURITY LEVELS IN CUBIC SILICON CARBIDE Ph.D. Thesis
Philip Allen Gaubis 1977 121 p
Avail: Univ. Microfilms Order No. 7810053

The two-phonon Raman spectra and nitrogen donor electronic Raman spectra of the 3C polytype (zinc-blende) of SiC are presented. The nitrogen impurity concentrations of both samples used are found to be well below the Mott transition. The lambda sub 1 component of the two-phonon spectra is the dominant component. The spectral feature assignments in conjunction with a lattice dynamical calculation are used to perform a critical point analysis. The low temperature spectra of both samples show the appearance of a line at 67.5 cm/1 of E symmetry. The thermal behavior of this line is investigated from 7 K to 180 K and indicates that the 1S(A1) level is the true ground state. Dissert. Abstr.

N78-29939 Illinois Univ. at Chicago Circle, Chicago.
DENSITIES OF STATES AND SPECTRAL WEIGHT FUNC-

TIONS FOR DISORDERED SYSTEMS Ph.D. Thesis
Antonios Gonis 1978 403 p
Avail: Univ. Microfilms Order No. 7811086

The single-site coherent-potential approximation and many of its past multisite extensions are reviewed and several practicable, multisite techniques for calculating densities of states and site spectral weight functions in disordered alloys are proposed. Both non-self-consistent and self-consistent methods are introduced. The results of numerical calculations are reported, for alloys with both diagonal and off-diagonal disorder. These calculations show that local environment fluctuations can have a large effect on site spectral weight functions. The subject of phonons in disordered alloys is discussed and theories originally developed for electron systems are generalized so as to be applicable to the case of phonons. Also, a generalization of the methods presented to real electronic systems is given.
Dissert. Abstr.

N78-29940 Illinois Univ. at Urbana-Champaign, Urbana.
ANNEALING STUDIES OF BERYLLIUM IN GALLIUM ARSENIDE AND GALLIUM ARSENIDE PHOSPHIDE Ph.D. Thesis
William Victor McLevige 1978 106 p
Avail: Univ. Microfilms Order No. 7811267

Differential resistivity and Hall effect measurements, secondary ion mass spectrometry (SIMS), and low temperature (5 K) photo-luminescence are utilized to study the annealing behavior of ion implanted beryllium in GaAs and GaAs0.6P0.4, and of beryllium incorporated in GaAs during growth by molecular beam epitaxy (MBE). For low fluence implants in GaAs, an electrical activation of 90-100%, and no significant diffusion is observed for annealing at 900 C with Si3N4 encapsulation. However, higher fluences result in a substantial redistribution of the implanted Be during the anneal, including outdiffusion into encapsulant. The annealing behavior of Be-implanted GaAs0.6P0.4 is similar to that for Be-implanted GaAs. However, greater dependences of the electrical activation and diffusion on temperature, defects, and surface-related effects are observed in the ternary.
Dissert. Abstr.

N78-29941 Oklahoma State Univ., Stillwater.
ENERGY TRANSFER AND DISSIPATION PROCESSES IN DOPED CRYSTALS Ph.D. Thesis
Robert Glen Peterson 1977 104 p
Avail: Univ. Microfilms Order No. 78-11062

Time resolved spectroscopy was used to investigate the host-sensitized energy transfer processes which occur in calcium tungstate crystals doped with trivalent samarium or europium ions after excitation into the long wavelength tail of the host absorption bands. Pulsed laser excitation into the long wavelength tail of the calcium tungstate host absorption bands directly excites tungstate molecular ions which are located next to activator impurities. The energy transfer taking place seems to be a single step, nearest neighbor process. Both the electric dipole-dipole and the exchange interaction transfer mechanisms appear equally likely to take place. Photoacoustic spectroscopic studies of radiationless relaxation processes and avenues of non-radiative decay in ruby and in chromium-doped MgO, SrTiO3, and BaTiO3 are discussed.
Dissert. Abstr.

N78-29942 Arizona Univ., Tucson.
USE OF OPERATOR EQUATION OF MOTION TECHNIQUES IN TREATING COLLECTIVE EXCITATIONS Ph.D. Thesis
David Andrew Poling 1978 126 p
Avail: Univ. Microfilms Order No. 78-11516

The concept of collective excitations in quantum many-body systems is discussed and a working definition is given. The operator equation of motion method of treating many-body problems is introduced and a number of variations are discussed. Example calculations examining plasma oscillations in a dense electron gas and sound propagation in a gas of hard core bosons are used to illustrate how the operator equation of motion method may be used on such collective systems. A variation on the operator equation of motion method is then applied to the problem of magnous in a Heisenberg ferromagnet and higher approximations are developed to magnon renormalization. Finally, expanding upon the earlier hard core boson calculation and making analogies to the Heisenberg ferromagnet, a quantum lattice gas model of (4)He is formulated.
Dissert. Abstr.

N78-29943 Columbia Univ., New York.
RELAXATION OF THIRD ORDER ELASTIC CONSTANTS IN CRYSTALS WITH POINT DEFECTS Ph.D. Thesis
Diane Susan Sarner Richter 1978 297 p
Avail: Univ. Microfilms Order No. 78-11150

The thermodynamics of nonlinear anelastic relaxation was investigated using a Taylor series expansion of the Helmholtz free energy function through cubic powers of the strain and defect concentration. The coefficients are identified as elastic constants, defect response tensors, and interaction tensors. The approach is based on group representation theory, which utilizes the symmetry of a crystal and of the point defects contained therein. The theoretical development is applied to the computation of relaxation magnitudes of the third order elastic constants for nitrogen or oxygen interstitials in niobium, at defect concentrations of 0.6 atomic percent.
Dissert. Abstr.

N78-29944 California Univ., Santa Cruz.
CRITICAL BEHAVIOR OF REGGEON FIELD THEORY ON A LATTICE Ph.D. Thesis
Miguel Alberto Furman 1977 180 p
Avail: Univ. Microfilms Order No. 7811545

The Hamiltonian form of Reggeon field theory on a lattice in the two dimensional (D=2) transverse or impact parameter spaces was studied. A formal proof of equivalence with the path-integral formalism is given. Then, based on results for the D=0 theory, the single-site spectrum of the Hamiltonian is truncated by retaining the lowest two states only. A lattice quantum spin Hamiltonian which preserves all the symmetries of the original one is obtained. By universality, this spin model is particularly suited for the study of the critical behavior of the original theory. Accurate results for the critical exponents are obtained by developing the high-temperature expansion of the propagator. This is a power series expansion in the intersite coupling of the spin Hamiltonian.
Dissert. Abstr.

N78-29945 Illinois Univ. at Chicago Circle, Chicago.
THE VALENCE-CORE EXCHANGE MODEL Ph.D. Thesis
Timothy Richard Gerrity 1978 176 p
Avail: Univ. Microfilms Order No. 78-11084

A new model for the elastic scattering of hadrons at high energies is proposed and tested. It is assumed that hadrons are composed of two components: a valence of ordinary SU(3) type quarks and an SU(2) symmetric core of non-strange quark-antiquark pairs. It is also assumed that quarks can be exchanged between the hadrons according to the rules of Harari-Freund duality and that the exchange of quarks contributes Regge-type behavior to the elastic amplitude. Pomeron exchange is allowed between any two quarks and the logarithmic energy dependence required by the total hadronic cross sections is inserted by hand.
Dissert. Abstr.

N78-29946 Illinois Univ. at Urbana-Champaign, Urbana.
THE THERMAL BOUNDARY CONDUCTANCE BETWEEN A THIN He-4 FILM AND ITS SUBSTRATE Ph.D. Thesis
James Edward Rutledge 1978 63 p
Avail: Univ. Microfilms Order No. 78-11287

Heat flow between the substrate and a thin He(4) film is responsible for the signal strength and the Q of a third sound resonance cell. Careful analysis of the signal strength and Q for films between 1.35 and 4.40 atomic layers shows that the boundary conductance between a thin film and its substrate is three to fiver orders of magnitude smaller than the boundary conductance between bulk liquid helium and a solid. The conductance for the bulk case is the reciprocal of the Kapitza resistance. For the thin films studied, if the boundary conductance is proportional to T sup n, n lies between six and eight. A possible mechanism for the boundary conductance is dicussed.
Dissert. Abstr.

N78-29947 Columbia Univ., New York.
DYNAMICS AND STABILITY OF CONTINUOUS CRYSTALLIZATION SYSTEMS: EVAPORATIVE CRYSTALLIZATION OF SUCROSE Ph.D. Thesis
Leszek Sowul 1978 486 p

Avail: Univ. Microfilms Order No. 7811154

Continuous, unseeded crystallizations of sucrose from aqueous solutions were carried out in a single stirred tank operating under vacuum. Experimental crystal size distribution dynamics were explained in terms of the interaction between crystal nucleation and crystal growth rates and the effects of secondary nucleation. An empirical model was proposed for the transient crystal size distributions and used to determine sucrose crystallization kinetics in this particular crystallizer configuration. Estimates of the relative kinetic orders obtained indicate that secondary nucleation mechanisms are operative. Nonlinear and linear computer simulations were performed to investigate the transient response of these secondary nucleation models to various disturbances in the input variables and for different combinations of the kinetic parameters. Dissert. Abstr.

N78-29948 Illinois Univ. at Urbana-Champaign, Urbana.
THE EFFECTS OF MELT-CRYSTAL INTERFACE TEMPERATURE RISE ON THE ANALYSIS OF CRYSTAL GROWTH IN BINARY BORATE GLASS MELTS Ph.D. Thesis
Lester Wynn Herron 1978 146 p
Avail: Univ. Microfilms Order No. 78-11250

A technique involving the use of a microcomputer, cinemicrographic equipment, and very small thermocouples permitted the simultaneous measurement of temperature, growth rate, and position with respect to time. A mixed control growth model is described in which the growth rate is controlled by a combination of heat flow and interface reaction. The growth of Li2B4O7 is shown to be controlled predominantly by the rate of energy loss from the interface while the growth of Na2B4O7 is shown to be predominantly interface controlled. The growth of SrB4O7 appears to be controlled by a combination of heat flow and interface reaction. An equation was developed to calculate the melt-crystal interface temperature rise for inorganic glass forming systems. This equation requires that only the growth rate and enthalpy of fusion of the crystal be known. Dissert. Abstr.

N78-29949 California Univ., Los Angeles.
TECHNIQUES OF MACROMOLECULAR CRYSTALLOGRAPHY Ph.D. Thesis
Cynthia Vianne Stauffacher 1978 336 p
Avail: Univ. Microfilms Order No. 78-11384

To tailor photographic alignment techniques to the crystals of biological macromolecules, the cone axis oscillation alignment method was developed. This technique replaces the classical three step alignment procedure with a single photograph, which has for these crystals, as great an accuracy as a small angle precession photograph and for large errors even greater clarity than Laue photographs. The shortened alignment time of this method preserves the crystal lifetime of these unstable specimens for data film exposure. Its exceptionally clear representation of reciprocal space allows a quick scan of the crystal to find the principal axes, and enables the characterization of unknown crystal systems. This procedure also provides a check of the layer line screen alignment, as well as often valuable information on the crystal axis normal to the plane of the data film. It is flexible enough to deal with the varying problems of macromolecular crystals and was successfully used with crystals of unit cell dimensions of 40 angstroms to 380 angstroms. Dissert. Abstr.

N78-29950 Florida Univ., Gainesville.
NUCLEAR RESONANCE IN DISPERSED SYSTEMS Ph.D. Thesis
Koahsiung Yang 1977 181 p
Avail: Univ. Microfilms Order No. 7811001

Continuous wave and pulse techniques were used to study deuteron NMR lineshape, resonance frequencies, and relaxation times in oil-water dispersions as a function of temperature and composition. The systems studied contain hexadecane, potassium oleate, hexanol (or pentanol), and water. The water/oil ratio determines the phases: W/O is less than or approximately 0.6 for microemulsions, W/O is approximately 1.0 for cylindrical rod liquid crystal, and W/O is greater than or approximately 1.2 for lamellar liquid crystal. A model in which the water molecules rapidly exchange between a bound state on the surfactant interface and a free state in the bulk liquid is used to explain many of the observations. Dissert. Abstr.

N78-29951 Michigan State Univ., East Lansing.
A STUDY OF THE VIBRATIONAL SPECTRA OF THE PARTIALLY-DEUTERATED POLYCRYSTALLINE ETHYLENES Ph.D. Thesis
Richard George Whitfield 1977 221 p
Avail: Univ. Microfilms Order No. 78-10136

The mid-infrared and Raman spectra of the partially-deuterated ethylenes, and of dilute mixed crystals of the partially-deuterated ethylenes in C2H4 and in one another were observed in order to gain more insight into the intermolecular force field of ethylene and those of molecular crystals in general. Information concerning the retention of the symmetry of the parent (C2H4) crystal as an effective symmetry in the partially deuterated crystals was also obtained. Various sets of atom-atom interaction potentials were used to calculate the lattice frequencies of the C2H4 crystal using recent single crystal X-ray data. The best interaction potential was used to calculate the lattice frequencies of the partially-deuterated ethylenes, assuming the crystal structure and symmetry is unchanged by the deuteration. Dissert. Abstr.

N78-29952 State Univ. of New York at Stony Brook.
SURFACE ACOUSTIC WAVE SCATTERING FROM GROOVES IN PIEZOELECTRIC SUBSTRATES Ph.D. Thesis
Sheau-Dong Wu 1978 107 p
Avail: Univ. Microfilms Order No. 78-10826

A field theory for the reflectivity of a generalized Rayleigh wave from a single shallow groove etched on a LiNbO3 substrate is presented. The scattering properties are studied by using a perturbation approach. Induced equivalent acoustic and electric sources which produce the reflected and scattered wave are determined. Calculated reflection coefficient agrees well with the known experimental results. Reflection characteristics due to different groove profiles are compared and listed in a table. In addition, group reflection from an array of periodic shallow grooves is also analyzed. The approach combines a field analysis with the coupled-mode formalism. The scattering characteristics of surface acoustic wave from a single groove are treated on three other commonly used piezoelectric materials. Formulation and computation results for reflection coefficient are presented. Some of the reflection coefficients are compared with the known experiments and are found in good agreement. Dissert. Abstr.

N78-29953 Southern Methodist Univ., Dallas, Tex.
THIN FILM GALLIUM ARSENIDE SOLAR CELLS AND CRYSTAL STRUCTURE DETERMINATION BY X-RAY DIFFRACTION Ph.D. Thesis
Huai-Tung Yang 1978 126 p
Avail: Univ. Microfilms Order No. 78-09995

This dissertation is concerned with two parts: (1) Thin film gallium arsenide metal-oxide-semiconductor solar cells on tungsten/graphite substrates, and (2) Crystal structures determination of two compounds by X-ray diffraction method. The objectives of the first part are concerned with the deposition of gallium arsenide films on foreign substrates and the fabrication and characterization of thin film gallium arsenide solar cells. Tungsten coated graphite was selected as the substrate for the deposition of gallium arsenide. The fabrication and characterization of metal-oxide-semiconductor solar cells were carried out. The main objective of this second part is to determine the stereochemistrys of N-(p-bromophenyl)-phenothiazine and 9-isopropylxanthene by the single crystal X-ray diffraction method. Dissert. Abstr.

N78-29954 Japan Broadcasting Corp., Tokyo. Image Devices Research Group.
DEFECT-FREE EPITAXIAL LAYERS FOR Si-VIDICON TARGETS
Shigeo Yoshikawa Dec. 1977 14 p refs
(NHK-Labs-Note-220) Copyright. Avail: Issuing Activity

Process-induced defects were eliminated from silicon-cadmium telluride Schottky-type diode array targets by using a floating zone technique in their fabrication. N-type (phosphorus doped) silicon crystals with resistivity of 10 ohm cm, grown in the (111) direction were used. Round wafers, 150 thick were sawed from these crystals. SiO2 film was formed about 6,000 A thick on one surface of the wafer by heating it at about 400 C for a few minutes with the chemical vapor deposition technique.

An array of diodes with a diameter of 6 micron in a spacing of 15 micron m (1,000 by 1,000 mosaic array) was produced by photolithographical etching. The other surface of the wafer was chemically etched away so that the active area would have the thickness of about 15 micron m. Although the targets contain no process-induced defects, growth striations and swirls remain. A.R.H.

N78-29955 Cornell Univ., Ithaca, N. Y.
DIFFRACTION AND HIGH RESOLUTION ELECTRON MICROSCOPY STUDIES OF A LINEAR DEFECT IN Zr-Nb b.c.c. SOLID SOLUTIONS Ph.D. Thesis
Tung-Sheng Kuan 1977 96 p
Avail: Univ. Microfilms Order No. 7807786

The structure of a new type of linear defect in the b.c.c. phase of solid solutions was determined using published diffuse scattering observations for a Zr-20 wt.% Nb alloy. The defect was shown to consist of a vacancy about which are rows of atoms displaced along (111) direction. High resolution dark field electron microscopy using diffuse scattering was employed in order to directly image the linear omega-like defect proposed to exist in Zr-Nb b.c.c. solid solutions. Phase contrast calculations were made of the defect image using the atomic structure of the omega-like linear defect model for different imaging conditions. Dark field images formed using two diffuse omega reflections, showed rows of white dots along the (111) direction, which were similar in appearance to the calculated images for the defect model. Quantitative measurements of the image intensity indicated that the observed images were from both single and superimposed linear defects. Dissert. Abstr.

N78-29956# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF A MULTIMODE LIQUID-CRYSTAL LIGHT VALVE Final Report, 1 Jun. 1976 - 31 Dec. 1977
W. P. Bleha, J. D. Margerum, L. J. Miller, G. D. Myer, P. G. Rief, D. S. Smythe, F. G. Yamagishi, and J. Grinberg May 1978 12 p refs
(Contract N00024-76-C-5366)
(AD-A054728) Avail: NTIS HC A02/MF A01 CSCL 07/4

Three major issues in the development of a multimode liquid-crystal light valve were addressed in this phase of the continuing research; Liquid-crystal electro-optical effect, Light valve stability and lifetime, and photoconductor performance. We concluded that the lifetime and stability of the tilted perpendicular alignment cannot be sufficiently improved to produce a practical and useful device for a high-brightness, large screen display system. The problem is that the molecular pre-tilt angle is unstable in the presence of a high-brightness projection light. The tilted perpendicular alignment therefore was abandoned in favor of the 45 deg. twisted nematic alignment using the hybrid field effect mode (HFE mode), by HRL. With respect to color symbology and multimode operation; however, the HFE mode was less suitable, and considerable experimentation with the goal of optimization was performed and is reported here. A phenomenological study was made on liquid-crystal cells operated in the HFE mode. The objectives were to optimize and to determine the range and intensity of colors that can be obtained with an HFE light valve and to acquire a working knowledge of the effect of certain cell parameters (e.g., twist angle, thickness, and the match or mismatch of the polarization plane with front surface alignment). GRA

N78-29957# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
ON THE INFLUENCE OF A FLEXURAL BIASING STATE ON THE VELOCITY OF PIEZOELECTRIC SURFACE WAVES
B. K. Sinha and H. F. Tiersten Apr. 1978 34 p refs
(Contract N00014-76-C-0368; NR Proj. 318-009)
(AD-A054397; TR-24) Avail: NTIS HC A03/MF A01 CSCL 20/3

A system of linear electroelastic equations for small fields superposed on a bias is applied in the determination of the velocity of acoustic surface waves in piezoelectric substrates subject to flexural biasing stresses. The influence of the biasing stresses appears in the boundary conditions as well as the differential equations. Direct calculations performed for both quartz and lithium niobate when the spatial variation of the flexural biasing state is omitted indicate that the biasing stresses in the boundary conditions have an important influence on the surface wave velocity. In addition, perturbation calculations are performed which include the influence of the spatial variation of all flexural biasing terms and it is shown that, for substrate thickness-to-wavelength ratios well within the practical range, the spatial variation in the biasing state has an appreciable effect on the velocity of acoustic surface waves. Author (GRA)

N78-29958# Purdue Univ., Lafayette, Ind. Turner Lab for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Final Report, 1 Feb. 1977 - 31 Jan. 1978
R. W. Vest 28 Feb. 1978 68 p refs
(Contract N00019-77-C-0327)
(AD-A054316) Avail: NTIS HC A04/MF A01 CSCL 20/12

Studies of the rate of dissolution of 96% Al2O3 substrates (AlSiMag 614) in a model glass (63 w/o PbO-20 w/o B2O3-10 w/o SiO2) were conducted as a function of temperature from 750 to 950 C. The rate limiting step was found to be molecular diffusion of substrate ingredients in the glass at times pertinent to thick film processing. Data from experiments on substrate dissolusion in glasses having varying amounts of substrate previously dissolved were utilized to develop an analytical expression which will give the substrate recession as a function of time and temperature for an actual thick film resistor; predictions of this equation compared favorably with experimental data. Studies of the influence of substrate constituents dissolved in the glass on the electrical properties of resistors showed a significant effect on both sheet resistance and temperature coefficient of resistance (TCR). The sheet resistance increased and the TCR decreased as the amount of substrate dissolved in the glass increased for the same processing conditions. These results are consistent with the present model of charge transport processes in thick film resistors. GRA

N78-29959# Army Materials and Mechanics Research Center, Watertown, Mass.
SOLID STATE FORMATION OF Nd:Y SUB 3 Al SUB 5 O SUB 12 Nd YAG Final Report
Dennis J. Viechnicki and Jaroslav L. Caslavsky Feb. 1978 11 p
(DA Proj. 1T1-62105-AH-84)
(AD-A054428; AMMRC-TR-78-7) Avail: NTIS HC A02/MF A01 CSCL 20/2

The formation of 1.1 at. % Nd:Y3Al5O12 (Nd:YAG) from mixed oxide starting powders after heating at 1650 C for 3 hours in air is reported for the first time. Cylindrical billets are produced with fired densities between 65% and 75% of theoretical suitable for use as meltstock for crystal growth by the heat exchanger method (HEM). Conditions for milling of the starting oxide powders to eliminate agglomerates which lead to formation of more volatile Y4Al2O9 and YAlO3 are discussed. A comparison is made between mixed oxides and hydrated salts for use as starting materials. Author (GRA)

N78-29960# Office of Naval Research, London (England).
THE SECOND INTERNATIONAL CONFERENCE ON THE ELECTRONIC PROPERTIES OF 2-DIMENSIONAL SYSTEMS
B. D. McCombe (Naval Research Lab., Wash., D. C.) 12 Apr. 1978 22 p Conf. held at London, Engl., 19-22 Sep. 1977
(AD-A054419; ONRL-C-5-78) Avail: NTIS HC A02/MF A01 CSCL 20/12

The Second International Conference on the Electronic Properties of Two Dimensional Systems, 19-22 September 1977, is reviewed critically. Topics discussed include: space charge layers in Si MOS structures; carrier localization, electric field subband spectroscopy and many-body effects, dc and high frequency magneto-conductivity, cyclotron resonance, charge density waves, surface 'superlattices'; electrons on liquid helium, bound state spectra and lifetimes, electron motion parallel to the surface, two dimensional plasmons, and Wigner crystallization; semiconductor superlattices; and other semiconductor MIS structures. Author (GRA)

N78-29961# Brown Univ., Providence, R. I. Dept. of Chemistry.
THE ELECTRICAL AND OPTICAL PROPERTIES OF THE SYSTEM TiO(2-x). THE ELECTRICAL, OPTICAL AND PHOTOCONDUCTING PROPERTIES OF Fe(2-x)Cr(x)OB (0 LESS THAN OR EQUAL TO x LESS THAN OR EQUAL TO 0.047) Technical Report, 1 Jul. 1977 - 31 May 1978
A. Wold, S. N. Subbarao, Y. H. Yun, R. Kershaw, and K. Dwight 31 May 1978 54 p refs Submitted for publication
(Contract N00014-77-C-0387; NR Proj. 359-653)
(AD-A053858; TR-4) Avail: NTIS HC A04/MF A01 CSCL 07/4

A convenient method for preparing compounds in the system TiO(2-x)Fx is described and the photoelectrolytic behavior of TiO(2-x) and TiO(2-x)Fx anodes was investigated. It was found that the substitution of small amounts of fluorine for oxygen in TiO2 increases the photocurrent output which arises from increased response at the longer wavelengths. The improved response may be attributed to the increase in depletion layer width which is supported by an observed increase in resistivity. A study was also carried out on the electrical, optical and photoconducting properties of pure and reduced single crystals of the composition Fe(2-x)CrxO3 where less than or = to 0.47. It was discovered that pure alpha Fe2O3 is not a photoconductor. A necessary condition for the observation of photocurrents in n-type Fe2O3 is that dome Fe3O4 be present. In addition, it was found that the substitution of chromium for iron in alpha Fe2O3 results in a montonically decreasing optical band gap as the chromium concentrations, x, increases. L.S.

N78-29962# Oak Ridge National Lab., Tenn.
NOTE ON THE CRYOSTATIC STABILITY OF SUPERCONDUCTING COMPOSITES
W. F. Gauster Feb. 1978 71 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5989) Avail: NTIS HC A04/MF A01

The equal area condition developed by Maddock et al is discussed. In order to make the essential points as clear as possible, analytical solutions are derived under simplifying assumptions (simple model for heat transfer by nucleate and film boiling liquid helium; constant heat conduction and specific heat) instead of using more realistic but less controllable computer calculations. A quantitative definition of the concept of a long wire is given. Numerical examples for the Maddock transition characterized by the equal area condition are given for a long superconducting composite with linear cooling and for a liquid helium-cooled resistance wire of finite length. In addition, cases are shown where instead of applying the equal area stability condition, time-dependent solutions should be considered. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N78-29963 Cornell Univ., Ithaca, N. Y.
NONLINEAR ORDER PARAMETER FIELDS. 1: SOLITON DYNAMICS. 2: THERMODYNAMICS OF A MODEL IMPURE SYSTEM Ph.D. Thesis
Martin Barry Fogel 1977 134 p
Avail: Univ. Microfilms Order No. 78-09802

The effects of various perturbations on the sine-Gordon soliton were studied using calculations based on linear perturbation theory. In many respects, the soliton behaves like a classical deformable particle subject to Newton's Second Law. A model is examined for an impure system consisting of coupled anharmonic chains where the coupling between chains is much weaker than along the chains. A particular form for the impurity is chosen and the one dimensional chain problem in the presence of impurities is solved. The mean field transition temperature is then computed for a one- and two-dimensional array of impure chains within the two state basis approximation. These results are discussed within the context of KCP.
Dissert. Abstr.

N78-29964 Georgia Inst. of Tech., Atlanta.
HEAT TRANSFER STUDIES FROM SINGLE CYLINDER AND TUBE BUNDLE IN FLUIDIZED BED Ph.D. Thesis
Ravinder Kumar Bansal 1978 273 p
Avail: Univ. Microfilms Order No. 78-10819

It was observed that at flow rates in the range of incipient fluidization, the onset of fluidization occurs at the tube sides, with a corresponding increase in local heat transfer coefficient in that region. As the fluidization velocity increases the activity near the defluidized cap at the top of the cylinder becomes more intense, with a consequent large increase in the local heat transfer coefficient in this region when compared to that in other regions. The average heat transfer coefficient based on the local values around the circumference was observed to increase with fluidization velocity for the range of particle sizes and types used in the investigation. Such an increase becomes more pronounced with increasing pitch-to-diameter ratios, levelling off at a value of the ratio of about 1.7. An empirical correlation together with an additional correction factor for the influence of the pitch-to-diameter ratio, are proposed. Dissert. Abstr.

N78-29965 Duke Univ., Durham, N. C.
HEAT TRANSFER CORRELATIONS FOR THE NUCLEATE, CONVECTIVE AND DISPERSED REGIONS OF HORIZONTAL IN-TUBE EVAPORATION Ph.D. Thesis
Roger Newell Whiteway 1977 181 p
Avail: Univ. Microfilms Order No. 78-10815

A model of improved accuracy is provided for predicting local heat transfer coefficients for horizontal in-tube. It is established that there are three regions which must be modeled: (1) nucleate region occurs generally at lower vapor mass qualities with a stratified flow pattern where heat flux is the dominant parameter, (2) convective region occurs at higher qualities typified by annular flow where the mass flow rate and the quality are the dominant parameters, and (3) dispersed or mist region occurs where liquid drops are entrained in the vapor and heat flux, mass flow rate and quality are all significant parameters. Correlating equations for the nucleate and convective regions are presented in graphical form. The heat transfer correlation for the dispersed region is presented as several easily computed equations. Dissert. Abstr.

N78-29966# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
THERMAL DYNAMIC PROPERTIES OF NiBr2 AND NiSO4 FROM 10 TO 1,200 K Technical Report, Jul. 1975 - Dec. 1976
J. M. Stuve, M. J. Ferrante, and H. G. Ko 1978 21 p refs
(PB-279646/4; BM-RI-8271; USBM-77/9) Avail: NTIS HC A02/MF A01 CSCL 07D

This Bureau of Mines investigation measured low-temperature heat capacities of NiBr2, 8 to 302 K, and NiSO4, 9 to 70 K. Standard entropies of NiBr2 and NiSO4 were 29.26 + or - .06 and 24.21 + or - .04 cal/K mole, respectively. The formation enthalpy of NiBr2(c) was determined by solution calorimetry at 298.15 K to be -50.64 + or - .31 kcal/mole. High-temperature enthalpies of NiBr2 and NiSO4 were measured by drop calorimetry to 1,150 and 1,002 K, respectively. Enthalpies, heat capacities, and related formation functions are tabulated to 1,200 K. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-29967# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A METHODOLOGY TO REGIONAL PLANNING M.S. Thesis [UMA METODOLOGIA DE PLANEJAMENTO REGIONAL]
Nair Borsato, Oswaldo Runha Filho, and Synval Delano Motta Runha May 1978 197 p refs In PORTUGESE; ENGLISH summary
(INPE-1263-TPT/087) Avail: NTIS HC A09/MF A01

A methodology of strategic regional planning is presented. Economic aspects of regional development are emphasized. Models, methods, and techniques are discussed. J.M.S.

N78-29968# Rutgers - The State Univ., New Brunswick, N. J.
INFORMATION SERVICE PLANNING AND EVALUATION: A GOAL PROGRAMMING APPROACH Ph.D. Thesis
T. J. McGeehan May 1978 167 p refs
(AD-A054108) Avail: NTIS HC A08/MF A01 CSCL 05/2

This paper discusses a generalized resource allocation and program planning model to aid information service managers optimize the value of an information program to their parent organization. The technique which is investigated is goal programming that incorporates both quantitative criteria and ordinal priorities into a common decision making system. It is a particularly powerful tool for dealing with a decision making environment in which there are conflicting goals and objectives. For the model which is described, thirty projects of a proposed operating program are evaluated in terms of fifty goal criteria representing six classes of organizational goals, including: (1) the range of available staff for information services, (2) the available budget, (3) the diversity of the overall program, (4) the capability of the information program to provide mandated functions, (5) concentration on basic services and products, and (6) concern over the agency's ability to keep pace with the demands for new and improved products and services. GRA

N78-29969# Nebraska Univ., Lincoln. Water Resources Center.
WATER PROBLEMS IN THE RURAL ENVIRONMENT: ALTERNATIVE SOLUTIONS FOR WATER SUPPLY AND WATERWASTE DISPOSAL
1978 142 p refs Proceedings of Conf. held at Lincoln, Neb., 4-5 Nov. 1976
(PB-279775/1) Avail: NTIS HC A07/MF A01 CSCL 13B

The current rural water situation is described. Rural water supply and wastewater disposal problems, including both quality and quantity, were considered. The socio-economic and technological aspects of alternative solutions to rural water problems and the various impacts involved in changing or improving the current situation were examined. Future research and related needs to solve various rural water problems were outlined. The conference focused on domestic and farmstead use of water. GRA

N78-29970# Control Data Corp., Arlington, Va. Engineering Management Operations.
INTERFACE MILESTONE MANAGEMENT (IM2) CONCEPT
Joseph C. Finnigan 1 Feb. 1978 54 p
(PB-279252/1; CDC-EMO-78-01) Avail: NTIS HC A04/MF A01 CSCL 05A

Interface events or milestones are the iterative interactions necessary between subsystem development managers that ensure the synergistic development of a total system by coordinating the progress of diverse technologies on a highly compressed time frame. PERT type networks provided the first meaningful framework for recognizing and resolving interface event problems on a scheduled basis. Interface Milestone Management (IM2) provides for the explicit communication of the responsibilities of two or more organizations in a project that must interact to achieve a given objective. IM2 can be added to any PERT, CPM or precedence system. A listing of documents pertinent to management and technical interfaces is appended. GRA

N78-29971# Environmental Protection Agency, Washington, D. C. Office of Research and Development.
LABORATORIES NEEDED TO SUPPORT LONG-TERM EXPLORATORY RESEARCH IN THE US ENVIRONMENTAL PROTECTION AGENCY: A REPORT TO THE PRESIDENT AND THE CONGRESS, 31 MARCH 1978
Dennis Tirpak, ed. Apr. 1978 56 p refs
(PB-279607/6; EPA-600/8-78-003) Avail: NTIS HC A04/MF A01 CSCL 05A

Alternative laboratory approaches by which EPA could conduct long-term environmental research are examined. Areas treated include the formation of present EPA laboratories and the R&D process flow; (2) eleven research areas where enhanced long term support would be beneficial; (3) advantages and disadvantages of using individual grants and contracts, Federal Contract Research Centers, University or other private centers, and Federal Laboratories for conducting long-term research; and (4) the options for conducting long-term Exploratory activities within EPA. GRA

N78-29972# National Science Foundation, Washington, D. C. Task Force on Science Applications.
REPORT OF THE SCIENCE APPLICATIONS TASK FORCE TO THE DIRECTOR OF THE NATIONAL SCIENCE FOUNDATION
Jul. 1977 124 p refs
(PB-279458/4; NSF-77-78; NSF/RA-770441) Avail: NTIS HC A06/MF A01 CSCL 05A

Programs and issues discussed by the task force include: (1) research applications RANN programs; (2) engineering programs in NSF; (3) social and behavioral sciences; (4) applications programs in other parts of NSF; (5) relations between NSF and other federal agencies; (6) relations with state and local governments; (7) relations with industry; (8) relations with professional societies and public interest groups; and (9) educational matters related to applications programs. Recommendations were made concerning the desirability of strengthening the two types of science applications activities within NSF; changes in management policy in order to make the research applications programs more effective; and relations between NSF and the outside community. GRA

N78-29973# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
STRATEGIES FOR CONDUCTING TECHNOLOGY ASSESSMENTS Final Report
Joe E. Armstrong and Willis W. Harman Dec. 1977 156 p refs
(Grant NSF ERS-75-22788)
(PB-279471/7; NSF/RA-770439) Avail: NTIS HC A08/MF A01 CSCL 05A

An attempt is made to synthesize from a sample of accumulated experience over the past ten years a guiding strategy to aid an interdisciplinary team in the conduct of a technology assessment. An array of operations, techniques, and procedures were assembled from theory and practice as candidates for the conduct of each of the fourteen identified tasks. Following the presentation of the basic strategy, four ways of categorizing technology assessments were identified and their effect on emphasis within the basic strategy was noted. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-29974# Hamilton Standard, Windsor Locks, Conn.
PRELIMINARY DESIGN OF AN ACCIDENT INFORMATION RETRIEVAL SYSTEM (AIRS) Final Report, Jun. 1976 - Aug. 1977
Henry R. Ask, Marston E. Moffatt, Ivor Hughes, Larry Brock, John Bikowski, and Charles B. Brahm Apr. 1978 277 p refs

(Contract DAAJ02-76-C-0058)
(HSER-7342; USARTL-TR-77-51) Avail: NTIS HC A13/MF A01

Current crash recorder technology was assessed to determine its suitability for providing data retrieval capability of Army helicopters investigating mishaps. Several design concepts are examined in terms of data storage memory types and sizes. The recommended system as accepted by the Army for preliminary design was further defined to obtain factors of size, weight, reliability, maintainability, survivability, and cost for new aircraft installation. The installation and aircraft interface is also addressed on the UTTAS helicopter as being typical of new aircraft installation. The recommended system employs all solid-state design including the mass data storage device. Factors of two or more improvements in size, weight, maintainability and reliability are indicated over current data recording systems. A.R.H.

N78-29975# Ohio State Univ., Columbus. Mechanized Information Center.

PROVIDING COMPUTER-BASED INFORMATION SERVICES TO AN ACADEMIC COMMUNITY Final Report, 1 Feb. 1971 - 31 Jan. 1975

Bernard Bayer Aug. 1977 138 p refs
(Grant NSF GN-27458)
(PB-278330/6; MIC-AN-04) Avail: NTIS HC A07/MF A01 CSCL 05B

The Mechanized Information Center (MIC) is a university-based science information system that provides search services to faculty, students and other members of an academic community, both on the campus and at other institutions (public and private) within the region. The major services are computer-based retrospective searches that bring a user up-to-date in his or her field and current awareness searches to keep a user up-to-date through weekly, bi-weekly or monthly updates. The report summarizes the development of the MIC system and includes descriptions of the MIC software and marketing techniques.GRA

N78-29976# Krall Management, Inc., Radnor, Pa.

THE VISIBILITY AND IMPACT OF ELECTRONIC STORAGE AND DELIVERY OF HANDBOOK-TYPE INFORMATION. VOLUME 1, PART 1: CHAPTERS 1-4. PART 2: CHAPTERS 5 AND APPENDICES Final Report

Sandra L. Burgoon and Charles R. Claydon, Jr. Aug. 1977 329 p refs Prepared in cooperation with Battelle Columbus Labs, Ohio
(Contract NSF C-1007)
(PB-278072/4) Avail: NTIS HC A15/MF A01 CSCL 05B

Electronic delivery capabilities were reviewed in relation to the breadth and complexity of handbook-type information being used by design engineers. The engineering disciplines and industries inpacted by handbook-type information were examined and the market acceptability and economic soundness of electronic delivery systems and services in several major industries were delineated. GRA

N78-29977# National Technical Information Service, Springfield, Va.

MACHINE TRANSLATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - May 1978

Mary E. Young May 1978 184 p Supersedes NTIS/PS-77/0484; NTIS/PS-76/0434; NTIS/PS-75/411; COM-73-11717 (NTIS/PS-78/0448/7; NTIS/PS-77/0484; NTIS/PS-76/0434; NTIS/PS-75/411; COM-73-11717) Avail: NTIS HC $28.00/MF $28.00 CSCL 05G

Studies on machine translation of various languages are cited. Topics concerning syntax, computer programming, computer hardware, and semantics are included. GRA

N78-29978# National Technical Information Service, Springfield, Va.

WALSH FUNCTIONS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Apr. 1978

George W. Reimherr May 1978 99 p Supersedes NTIS/PS-77/0414; NTIS/PS-761-0379; NTIS/PS-75/378; COM-73-11580 (NTIS/PS-78/0508/8; NTIS/PS-77/0414; NTIS/PS-76/0379; NTIS/PS-75/378; COM-73-11580) Avail: NTIS HC $28.00/MF $28.00 CSCL 09D

Multidisciplinary applications of Walsh functions. in signal processing are cited. Emphasis is placed on the use of Walsh functions in information theory, pattern recognition, image processing, data processing, and data transmission. The necessary software and numerical analysis are cited. GRA

N78-29979*# National Bureau of Standards, Washington, D. C. Library Div.

UNION LIST OF SERIALS, 1977, SECOND EDITION

1977 382 p Supersedes the Union list of serials, 1975 Sponsored in part by EPA, FDA, NASA, NOAA and the US Patent and Trademark Office
(NASA-CR-156944; PB-279169/7) Avail: NTIS HC A17/MF A01 CSCL 05B

The second edition of this joint listing of serials includes the holdings of the following library systems: U.S. Environmental Protection Agency (EPA) (including the Illinois Institute for Environmental Quality); Food and Drug Administration, Bureau of Foods Library (FDA); National Aeronautics and Space Administration (NASA); National Bureau of Standards (NBS); National Oceanic and Atmospheric Administration (NOAA); and U.S. Patent and Trademark Office. This report includes 16,362 titles and 41,649 holdings. The arrangement is alphabetical by title. GRA

N78-29980# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.

CRITICAL FIELD EXPERIMENTS ON USES OF SCIENTIFIC AND TECHNICAL INFORMATION Final Report

Albert H. Rubenstein, C. W. N. Thompson, and Robert D. OKeefe (DePaul Univ., Chicago) Nov. 1977 39 p
(Grant NSF GN-042305)
(PB-279693/6; POMRAD-77/68) Avail: NTIS HC A03/MF A01 CSCL 05B

This is a two year project designed to identify potentially researchable questions and to develop experimental designs as a basis for future research that might be supported by the Division of Science Information, consistent with its purposes of (1) gaining an improved understanding of the factors affecting information-seeking, -purchasing, and -using behavior in the area of scientific and technical information (STI) and (2) assessing the technical and economic feasibility of potential STI innovations. GRA

N78-29981# Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.

APPROPRIATE TECHNOLOGY FOR NATURAL RESOURCES DEVELOPMENT: AN OVERVIEW, ANNOTATED BIBLIOGRAPHY, AND A GUIDE TO SOURCES OF INFORMATION

Robert L. Bulfin and Harry L. Weaver 1977 174 p refs Prepared for the Agency for International Development, Washington, D. C.
(PB-279193/7) Avail: NTIS HC A08/MF A01 CSCL 05B

Each application of technology requires a special fit to go with a specific problem: the people, the environment, the economics, the power available, and the politics. The philosophy of intermediate technology, which advocates the use of the most appropriate (rather than the most modern) technology, is examined in relation to developing countries. A bibliography of information sources on appropriate technology lists organizations, and publications related to the topic. GRA

N78-29982# George Washington Univ. Medical Center, Washington, D.C. Science Communication Div.

CRITICAL ISSUES IN SCIENTIFIC AND TECHNICAL COMMUNICATION: PERCEPTIONS OF USERS, PROVIDERS AND POLICYMAKERS Final Report, 1976 - 1978

Elizabeth B. Adams and Sally A. Rood 1978 140 p Proceedings of the Users' Perspective Conf., Boston, 11 Nov. 1976; the Providers' Perspective Conf., Calif., 18 Feb. 1977; and the Policymakers' Perspective Conf., Smithsonian Inst., 2 Jun. 1977
(Contract NSF C-DS172-02700-A17)
(PB-279382/6; GWU-SCD-78/1) Avail: NTIS HC A07/MF A01 CSCL 05B

Empirical data collected by questionnaire and from participants at three workshops on needs in scientific and technical communication are summarized. Issues discussed include: (1) access to information; (2) economic factors influencing information systems; (3) delineation of roles and responsibilities; (4)

requirements for new functional activities; and (5) requirements for centralized planning for scientific and technical communication. Specific recommendations include the establishment of a focal point within the federal government for information policy, and the designation of liaisons for users, providers, generators, and technologists. The workshops, conducted during 1976 and 1977, were held at the Boston Museum of Science (users' perspective), the California Academy of Sciences (providers' perspectives), and the Smithsonian Institution National Museum of History and Technology (policymakers' perspective). A.R.H.

N78-29983# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
SCIENTIFIC AND TECHNICAL PUBLICATION OF THE ENVIRONMENTAL RESEARCH LABORATORIES: FISCAL YEAR 1976 (1 JULY 1975 THROUGH 30 SEPTEMBER 1976)
Oct. 1977 37 p
(PB-280786/5; NOAA-78041210) Avail: NTIS HC A03/MF A01 CSCL 05B

This bibliography lists 797 scientific and technical publications of the Environmental Research Laboratories for the period July 1, 1975 through September 30, 1978. All known publications in journals for this period, as well as those published within the official report series of the laboratories are listed. Topic covered include: ocean processes and their interactions with the atmosphere; the ocean environment as it is affected by waste disposal and development of energy resources; the weather and climates; and weather modification and environmental effects of global pollution. GRA

N78-29984# General Accounting Office, Washington, D. C. General Government Div.
TIMELINESS AND COMPLETENESS OF FBI RESPONSES TO REQUESTS UNDER FREEDOM OF INFORMATION AND PRIVACY ACTS HAVE IMPROVED
10 Apr. 1978 104 p
(PB-279416/2; GGD-78-51) Avail: NTIS HC A06/MF A01 CSCL 05B

The completeness and timeliness of information provided by the FBI under the Freedom of Information Act and the Privacy Act is discussed. Various problems which hamper FBI efforts to effectively comply with requests are cited. It is recommended that the Congress modify the legislation and that the Attorney General improve management procedures. GRA

N78-29059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATING AIRLINE OPERATING COSTS
Dal V. Maddalon *In its* CTOL Transport Technol., 1978 1978 p 849-870 refs (For primary document see N78-29046 20-01) Avail: NTIS HC A18/MF A01 CSCL 05C

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-29985# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
ENERGETICS AND SYSTEMS MODELING: A FRAMEWORK STUDY FOR ENERGY EVALUATION OF ALTERNATIVE TRANSPORTATION MODES Final Report
Suzanne Bayley, James Zucchetto, Larry Shapiro, Debbie Mau, and John Nessel Dec. 1977 189 p refs
(Contract DACW17-75-C-0075)
(AD-A053690; IWR-CR-77-10) Avail: NTIS HC A09/MF A01 CSCL 05/3

Report compares economic and energetic approaches for evaluating transportation systems. Discusses general energy theory, methods for calculating the energy value of goods and services, energy flows associated with natural systems, and energy benefit/cost analysis as applied to alternative modes for transportation of bulk commodities. Direct and indirect energy costs of transporting coal, or its energy equivalent, are evaluated, with energy costs per ton-mile and energy yield ratios (i.e., units of energy transported per unit of energy cost) compared for barge, slurry pipeline, railroad and electric transmission line systems. Author (GRA)

N78-29986# Research Inst. of National Defence, Stockholm (Sweden).
SIMPLE EMPIRICAL COST MODEL FOR AIRCRAFT [EN ENKEL KOSTNADSMODELL FOER FLYGPLAN]
G. Lennart Magnusson Nov. 1977 18 p In SWEDISH; ENGLISH summary
(FOA-C-20205-D8(M4)) Avail: NTIS HC A02/MF A01

A very simple empirical cost model is presented covering fly-away prices for civil and military, old and new, large and small aircraft. The fly-away price is found to be one Swedish 1977 year Crown per installed unit of power (watt) in the aircraft referring to the mean of the first 100 aircraft. The cost model is intended for use in systems analysis and cost effectiveness studies where simple instruments are needed to connect quality and cost, performance and cost, etc. The model alone does not suffice for calculating the acquisition cost (sales price) for a specific and complete aircraft. The cost model is used for comments on some projects of current interest, such as the Swedish light attack aircraft (B3LA) and the Cruise Missile evolution. Author (ESA)

N78-29987# National Technical Information Service, Springfield, Va.
ECONOMIC MODELS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr. 1975 - Apr. 1977
George W. Reimherr May 1978 373 p
(NTIS/PS-78/0440/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 05C

A bibliography containing 366 abstracts concerning broad applications of economic models to specific economies and markets is presented. The economic models are used in forecasting and planning for various industries and businesses, environmental research, and the development of natural resources. Mathematical programming, computer programming, and theory are also included. GRA

N78-29988# Brookings Institution, Washington, D. C.
THE INTERDEPENDENCE OF NATIONS: AN AGENDA FOR RESEARCH
Robert Solomon and Anne Gault Dec. 1977 140 p refs
(Grant NSF AER-76-12283)
(PB-279472/5; NSF/RA-780003) Avail: NTIS HC A07/MF A01 CSCL 05C

The six month pilot study of international interdependence identifies unmet research needs and proposes an integrated program of studies of interdependence that would help to resolve national policy issues. The authors discuss a number of aspects of international interdependence--giving some aspects an historical perspective--and set forth a series of proposed research projects. The focus is on economic issues. GRA

N78-29989# Employment and Training Administration, Washington, D. C. Office of Research and Development.
A REVIEW OF ENERGY MODELS WITH PARTICULAR REFERENCE TO EMPLOYMENT AND MANPOWER ANALYSIS Final Report
Albert J. Eckstein and Dale M. Helen Mar. 1978 173 p refs
(PB-279447/7) Avail: NTIS HC A08/MF A01 CSCL 05C

A review of existing energy models to determine their usefulness with respect to energy-employment issues is presented. Includes an introduction and overview of the energy problem, and identification of the policy issues which predated much of the energy modeling effort. General conclusions from the review of energy models are presented. The report concludes with a discussion of the various employment and manpower issues associated with the energy problem. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-29990 Kansas State Univ., Manhattan.
NUMERICAL SIMULATION AND OPTIMIZATION OF CHEMICAL PROCESSES-APPLICATION TO SOLID WASTE GASIFICATION Ph.D. Thesis
John Carl Heydweiller 1977 160 p
Avail: Univ. Microfilms Order No. 78-11419

A general procedure for the dynamic simulation of chemical processes is presented which permits the processing units to be described by both distributed and lumped parameter models. The partial differential equations resulting from a distributed parameter model are transformed into a set of ordinary differential equations by discretizing the spatial variable and coupled to the sets from other units through the boundary conditions. The resulting large set of time-dependent ordinary differential equations is solved simultaneously using a Gear-type integrator. The method is demonstrated by considering the start-up of a process composed of a tubular reactor, a gas absorption column and a completely mixed tank. A performance model for a twin, fluidized bed reactor system for the gasification of solid waste is developed and subsequently used in an optimization of the reactor system. The model for each reactor includes the heat and mass balances around an individual solid particle as well as those around the reactor. Dissert. Abstr.

N78-29991 Stanford Univ., Calif.
SOURCES AND CHARACTERISTICS OF SOLUBLE ORGANIC NITROGEN IN ACTIVATED-SLUDGE EFFLUENTS Ph.D. Thesis
Gene Francis Parkin 1978 258 p
Avail: Univ. Microfilms Order No. 78-08821

Minimum effluent soluble organic nitrogen (SON) concentrations can be expected to occur when municipal activated-sludge plants are operated at conventional loadings, such as aeration times of six hours and solid retention time of four to ten days. About 20 to 40 percent of the SON in effluents from normal activated-sludge operation under these optimal conditions is produced biologically during treatments; the remainder is residual material from the original wastewater. Activated-sludge treatment can remove from 60 to 70 percent of the SON and 70 to 80 percent of the soluble chemical oxygen demand (SCOD) in untreated municipal wastewaters. Significantly more SON was removed by cationic exchange at pH 2.0 (33 to 56 percent) than by anionic exchange at pH 9.5(10 to 24 percent) for all wastewaters tested. Cationic exchange at pH 2.0 selectively removed more biologically produced SON relative to SCOD. Dissert. Abstr.

N78-29992*# Booz-Allen and Hamilton, Inc., Cleveland, Ohio. Design and Development Div.
PRELIMINARY POWER TRAIN DESIGN FOR A STATE-OF-THE-ART ELECTRIC VEHICLE Final Report
Phillip Mighdoll and William F. Hahn Apr. 1978 144 p refs
(Contracts NAS3-20595; EC-77-A-31-1044)
(NASA-CR-135341; DOE/NASA/0595-78/1) Avail: NTIS HC A07/MF A01 CSCL 13F

Power train designs which can be implemented within the current state-of-the-art were identified by means of a review of existing electric vehicles and suitable off-the-shelf components. The affect of various motor/transmission combinations on vehicle range over the SAE J227a schedule D cycle was evaluated. The selected, state-of-the-art power train employs a dc series wound motor, SCR controller, variable speed transmission, regenerative braking, drum brakes and radial ply tires. Vehicle range over the SAE cycle can be extended by approximately 20% by the further development of separately excited, shunt wound DC motors and electrical controllers. Approaches which could improve overall power train efficiency, such as AC motor systems, are identified. However, future emphasis should remain on batteries, tires and lightweight structures if substantial range improvements are to be achieved. Author

N78-29993*# Springborn Labs., Inc., Enfield, Conn.
BREADBOARD WASH WATER RENOVATION SYSTEM Final Report, 15 Jul. 1977 - 15 Jul. 1978
1978 40 p
(Contract NAS9-15369; Proj. 6037.6)
(NASA-CR-151818) Avail: NTIS HC A03/MF A01 CSCL 13B

A total wash water renovation system concept was developed for removing objectionable materials from spacecraft wash water in order to make the water reusable. The breadboard model system described provides for pretreatment with ferric chloride to remove soap by chemical precipitation, carbon adsorption to remove trace dissolved organics, and ion exchange for removal of dissolved salts. The entire system was put into continuous operation and carefully monitored to assess overall efficiency and equipment maintenance problems that could be expected in actual use. In addition, the capacity of the carbon adsorbers and the ion-exchange resin was calculated and taken into consideration in the final evaluation of the system adequacy. The product water produced was well within the Tentative Wash Water Standards with regard to total organic carbon, conductivity, urea content, sodium chloride content, color, odor, and clarity. A.R.H.

N78-29994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A STIRLING ENGINE COMPUTER MODEL FOR PERFORMANCE CALCULATIONS Final Report
Roy Tew, Kent Jefferies, and David Miao Jul. 1978 102 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-78884; DOE/NASA/1011-78/24; E-9613) Avail: NTIS HC A06/MF A01 CSCL 10B

To support the development of the Stirling engine as a possible alternative to the automobile spark-ignition engine, the thermodynamic characteristics of the Stirling engine were analyzed and modeled on a computer. The modeling techniques used are presented. The performance of an existing rhombic-drive Stirling engine was simulated by use of this computer program, and some typical results are presented. Engine tests are planned in order to evaluate this model. Author

N78-29995*# Econergy Inc., Los Angeles, Calif.
A STUDY OF CHARACTERISTICS OF INTERCITY TRANSPORTATION SYSTEMS. PHASE 1: DEFINITION OF TRANSPORTATION COMPARISON METHODOLOGY
J. Morley English, Jeffrey L. Smith, and Melvin W. Lifson Aug. 1978 202 p refs Sponsored in part by DOT
(Contract NAS2-9814)
(NASA-CR-152153-1) Avail: NTIS HC A10/MF A01 CSCL 13F

Decision making in early transportation planning must be responsive to complex value systems representing various policies and objectives. The assessment of alternative transportation concepts during the early initial phases of the system life cycle, when supportive research and technology development activities are defined, requires estimates of transportation, environmental, and socio-economic impacts throughout the system life cycle, which is a period of some 40 or 50 years. A unified methodological framework for comparing intercity passenger and freight transportation systems is described and is extended to include the comparison of long term transportation trends arising from implementation of the various R & D programs. The attributes

of existing and future transportation systems are reviewed in order to establish measures for comparison, define value functions, and attribute weightings needed for comparing alternative policy actions for furthering transportation goals. Comparison criteria definitions and an illustrative example are included. A.R.H.

N78-29996*# Econergy Inc., Los Angeles, Calif.
A STUDY OF CHARACTERISTICS OF INTERCITY TRANSPORTATION SYSTEMS. PHASE 1: DEFINITION OF TRANSPORTATION COMPARISON METHODOLOGY Executive Summary
J. Morley English, Jeffrey L. Smith, and Melvin W. Lifson Aug. 1978 42 p Sponsored in part by DOT
(Contract NAS2-9814)
(NASA-CR-152153-2) Avail: NTIS HC A03/MF A01 CSCL 13F

The objectives of this study are: (1) to determine a unified methodological framework for the comparison of intercity passenger and freight transportation systems; (2) to review the attributes of existing and future transportation systems for the purpose of establishing measures of comparison. These objectives were made more specific to include: (1) development of a methodology for comparing long term transportation trends arising from implementation of various R&D programs; (2) definition of value functions and attribute weightings needed for further transportation goals. G.Y.

N78-29997# American Univ., Washington, D. C. Dept. of Chemistry.
EVALUATION OF HIGH PERFORMANCE LIQUID CHROMATOGRAPHY PACKINGS FOR THE CONCENTRATION AND SEPARATION OF ORGANIC MATERIALS IN WATER Interim Report, 1 Jun. 1976 - 15 Sep. 1977
Andrew Welebir, William M. DAngelo, Sanford W. Bigelow, and Mary H. Aldridge 28 Nov. 1977 40 p refs
(Contract N00173-76-C-8183)
(AD-A053652) Avail: NTIS HC A03/MF A01 CSCL 13/2

Amberlite XAD-4 non-ionic adsorbent has been evaluated as a reverse phase concentrating agent for some aromatic and aliphatic compounds present in oily wastes dissolved in water retention efficiencies of 86 - 88% were found by extracting water samples before and after passing through XAD-4, aromatic concentrations being determined by liquid chromatography and aliphatic concentrations by an infrared technique. Effects of flow rate, sample size, and the weight of XAD-4 on retention efficiency are discussed. XAD-4 has proven to be an excellent trapping agent for trace amounts of organic compounds in water. GRA

N78-29998# California Univ., Berkeley. Lawrence Radiation Lab.
INDUCTIVE POWER COUPLING FOR AN ELECTRIC HIGHWAY SYSTEM
J. G. Bolger, F. A. Kirsten, and L. S. Ng Jan. 1978 10 p ref Presented at the IEEE Vehicular Technol. Conf., Denver, 24 Mar. 1978
(Contract W-7405-eng-48)
(LBL-7262; Conf-780303-2) Avail: NTIS HC A02/MF A01

A dual mode electric transportation system is described in which energy is electromagnetically transferred from a powered roadway to moving vehicles. Energy from the roadway can be used for high-speed, long-range travel and for replenishing energy stored in the vehicle in batteries or flywheels. The stored energy is then available for short-range travel off the powered highway network. The power coupling between roadway and vehicle is functionally similar to a transformer. A source is embedded in the roadway flush with the surface. When the vehicle's pickup is suspended over the source, energy is magnetically coupled through the clearance air gap between pickup and roadway source. The electromagnetic coupling mechanism was extensively studied through computer models, circuit analyses, and by tests of a full-size physical prototype. The results of these tests are described. ERA

N78-29999# National Technical Information Service, Springfield, Va.
AERATION OF SEWAGE LAGOONS, RESERVOIRS, AND STREAMS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1978
Robena J. Brown May 1978 216 p Supersedes NTIS/PS-77/0398; NTIS/PS-76/0280 2 Vol.
(NTIS/PS-78/0434/7; NTIS/PS-ML/0280) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The worldwide reports cited in this bibliography cover both sewage aeration lagoons as well as the mechanical aeration of streams and reservoirs. The section on aeration lagoons covers their design and performance in treating both municipal, industrial, and agricultural wastes. The second section covers reports on the use of mechanical aerators to improve the water quality of lakes, rivers and reservoirs. GRA

N78-30000# National Technical Information Service, Springfield, Va.
AERATION OF SEWAGE LAGOONS, RESERVOIRS, AND STREAMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1978
Robena J. Brown May 1978 253 p Supersedes NTIS/PS-77/0397; NTIS/PS-76/029; NTIS/ PS-75/357; COM-73-11707 2 Vol.
(NTIS/PS-78/0433/9; NTIS/PS-77/0397; NTIS/PS-76/0279; NTIS/PS-75/357; COM-73-11707) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

These Federally funded reports are divided into two sections. The first covers aeration lagoons used in biological waste treatment, including municipal sewage treatment as well as treatment of agricultural wastes. The second section cites studies on the mechanical aeration of streams and reservoirs to improve their water quality. GRA

N78-30001# Massachusetts Inst. of Tech., Cambridge.
HIGH ENERGY ELECTRON RADIATION OF WASTE-WATER LIQUID RESIDUALS
31 Dec. 1977 154 p refs
(Grant NSF ENV-74-13016)
(PB-279489/9; NSF/RA-770440) Avail: NTIS HC A08/MF A01 CSCL 13B

The destruction of pathogenic microorganisms and toxic chemicals in liquid municipal sludges, by the injection of energized electrons to permit its safe and economic application on land for agricultural use or for disposal was demonstrated. Chemical engineering studies related to the observed modification of electron treated sludges toward lower filtration resistance, improved dewatering properties, and clearer effluent are discussed. Engineering information useful for the early utilization of energized electrons for sludge disinfection is presented. The economics and energy use in electron treatment of contaminated water and sludge are reported. Several modes of utilizing electron treatment in the disinfection of municipal sludges are summarized. GRA

N78-30002# Culp/Wesner/Culp, El Dorado Hills, Calif.
OPERATIONS MANUAL: SLUDGE HANDLING AND CONDITIONING Final Report
William F. Ettlich, Daniel J. Hinrichs, and Thomas S. Lineck Feb. 1978 355 p
(Contract EPA-68-01-4424)
(PB-279449/3; EPA-430/9-78-002) Avail: NTIS HC A16/MF A01 CSCL 13B

Operation and maintenance of various sludge processing, conditioning, and disposal systems at wastewater treatment plants is described. Emphasis is placed on the establishment of good operational procedures, proper testing, and effective measures and procedures for detection and correction of operational problems. GRA

N78-30003# Culp/Wesner/Culp, El Dorado Hills, Calif.
FIELD MANUAL FOR PERFORMANCE EVALUATION AND TROUBLESHOOTING AT MUNICIPAL WASTEWATER TREATMENT FACILITIES Final Report
Gordon L. Culp and Nancy Folks Heim Jan. 1978 411 p Supersedes PB-228849
(Contract EPA-68-01-4418)
(PB-279448/5; EPA-430/9-78-001; PB-228849) Avail: NTIS HC A18/MF A01 CSCL 13B

A field guide or reference document for use in improving the performance of Municipal Wastewater Treatment Plants is

presented. A troubleshooting guide for identifying, analyzing and solving problems is also given. GRA

N78-30004# Stevens, Thompson and Runyan, Inc., Portland, Oreg.
PACKAGE TREATMENT PLANTS: OPERATIONS MANUAL Final Report
Chuck Zickefoose Apr. 1977 97 p
(Contract EPA-68-01-3547)
(PB-279444/4; EPA-430/9-77-005) Avail: NTIS HC A05/MF A01 CSCL 13B

Operation of a package treatment plant is described. Detailed descriptions of the duties and responsibilities of the owner are given. Design problems found in some package plants are included. GRA

N78-30005# Stevens, Thompson and Runyan, Inc., Portland, Oreg.
STABILIZATION PONDS: OPERATIONS MANUAL Final Report
Chuck Zickefoose and Joe R. B. Hayes Aug. 1977 82 p refs
(Contract EPA-68-01-3547)
(PB-279443/6; EPA-430/9-77-012) Avail: NTIS HC A05/MF A01 CSCL 13B

Basics for those wishing to brush up on fundamentals or get acquainted with types of ponds, terminology, and factors to consider in operation are presented. Sampling, flow control, and use of information gained from either visual, nasal or laboratory investigation are considered. Housekeeping and day-to-day activities are presented, along with a suggested checklist, which can be adapted for the individual plant. A number of potential problems and solutions that other operators have found to be helpful, are included. Major points are given on safety. GRA

N78-30006# Bechtel Corp., San Francisco, Calif.
RAPID TRANSIT SUBWAYS: GUIDELINES FOR ENGINEERING NEW INSTALLATIONS FOR REDUCED MAINTENANCE Report, Jul. 1975 - Mar. 1977
James Birkmyer Jan. 1978 119 p
(Contract DOT-TSC-1078)
(PB-279453/5; UMTA-MA-06-0025-78-2; DOT-TSC-UMTA-78-2) Avail: NTIS HC A06/MF A01 CSCL 13F

Awareness of the impact of environmental conditions is a prerequisite for the economic design of subways and the optimization of installation and maintenance costs of all major constituent items. Guidelines and justifications for good design practices discussed cover waterproofing, cathodic protection, structural engineering, ventilation pumps, escalators, automatic lubrication, and illumination and monitoring in stations. GRA

N78-30007# Texas Advisory Commission on Intergovernmental Relations, Austin.
SOLID WASTE MANAGEMENT: IMPLEMENTING THE FEDERAL RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 IN TEXAS
N. David Spurgin, Cynthia P. Keever, and R. Bruce Hatfield Sep. 1977 57 p refs
(PB-279311/5) Avail: NTIS HC A04/MF A01 CSCL 13B

Texas state and local governments already have an advanced program for disposing of solid waste under regulated conditions intended to protect public health and the quality of our air and water. Implementation of the Federal act may strengthen this program and may encourage attempts to develop energy and natural resource recovery projects. GRA

N78-30008# American Public Works Association, Chicago, Ill.
SEWER SYSTEM EVALUATION, REHABILITATION AND NEW CONSTRUCTION; A MANUAL OF PRACTICE Final Report, Jul. 1974 - Aug. 1976
Richard H. Sullivan, Morris M. Cohn, Thomas J. Clark, William Thompson, and John Zaffle Dec. 1977 195 p refs
(Grant EPA-S-803151)
(PB-279248/9; EPA-600/2-77-017D) Avail: NTIS HC A09/MF A01 CSCL 13B

This manual of practice prepared for use by local authorities and consulting engineers for the investigation of sewer systems for infiltration/inflow, discusses sewer system evaluation, sewer rehabilitation, and design of new systems to minimize infiltration/inflow. Procedures for conducting the system analysis and sewer system evaluation study are described. Sewer cleaning equipment and methods of sewer inspection are discussed. Factors which govern the cost of conducting work are given. Rehabilitation techniques and an analysis of factors to be considered for each method are included. GRA

N78-30009# Transportation Research Board, Washington, D. C.
URBAN TRANSPORTATION ECONOMICS: PROCEEDINGS OF FIVE WORKSHOPS ON PRICING ALTERNATIVES, ECONOMIC REGULATIONS, LABOR ISSUES, MARKETING, AND GOVERNMENT FINANCING RESPONSIBILITIES
Irvin P. Halpern et al 1978 267 p refs Sponsored in part by EPA, FEA and DOT
(PB-279689/4; TRB/SR-181; ISBN-0-309-02663-6) Avail: NTIS HC A12/MF A01 CSCL 05A

The long-term forces in the urban transportation market that generate chronic transit deficits were examined along with alternative courses of action to improve economic efficiency and financial viability at the local level. A practical working program for both those who plan and implement policy at the local level and those who develop and administer financial programs at the state and federal levels is given. The financial difficulties that contribute to the deterioration of service for users of both public and private transportation in cities and public transportation deficits are among the topics covered. GRA

N78-30010# Syracuse Research Corp., N. Y.
ADOPTION AND UTILIZATION OF URBAN TECHNOLOGY: A DECISION-MAKING STUDY, ANALYSIS AND CONCLUSION, PART 2
W. Henry Lambright Sep. 1977 297 p refs
(Grant NSF RDA-75-19704)
(PB-279541/7; SRC-TR-77-513-Pt-2; NSF/PRA-7519704/2/7-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 05K

The organizational problem-solving process model which provides a framework for analysis as to how and why new technologies are utilized or rejected by local governments is described. It is suggested that innovation occurs over stages with the pace and direction of innovation depending upon the capacity of local entrepreneurs to bring about coalitions of support sufficient to overcome whatever barriers may stand in the way of the technology. It is concluded that decision-making in innovation is a problem-solving process. The problem to be solved is two-fold: (1) to choose a technology that meets an organizational need; and (2) to steer the chosen solution through the constraints lying in the path of routine use. GRA

N78-30011# Weston Environmental Consultants-Designers, West Chester, Pa.
MULTIPLE WATER SUPPLY APPROACH FOR URBAN WATER MANAGEMENT Annual Report
Arun K. Deb 20 Mar. 1978 132 p refs
(Grant NSF ENV-76-18499)
(PB-279768/6; NSF/RA-780030) Avail: NTIS HC A07/MF A01 CSCL 13B

A systems model was developed to help cities, planners and engineers to decide whether the multiple supply approach to urban water management is beneficial in long-term planning of water resources. Three grades of water were considered in developing the model: potable, subpotable, and nonpotable. Basic water supply data were generated by conducting surveys of water supply systems serving populations around 20,000, 100,000 and 500,000 people all over the country. Cost functions of 36 unit processes were developed and incorporated in the model. The model is very flexible and can handle a conventional system, a dual or multiple system including reuse, or a regional system with up to 10 cities. GRA

N78-29060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD FOR THE ANALYSIS OF THE BENEFITS AND COSTS FOR AERONAUTICAL RESEARCH AND TECHNOLOGY
Louis J. Williams, Herbert H. Hoy, and Joseph L. Anderson *In*

NASA. Langley Res. Center CTOL Transport Technol., 1978 1978 p 871-884 refs (For primary document see N78-29046 20-01)
Avail: NTIS HC A18/MF A01 CSCL 05A

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-30012 Cornell Univ., Ithaca, N. Y.
FAR-INFRARED PHOTOMETRY WITH AN 0.4-METER LIQUID HELIUM COOLED BALLOON-BORNE TELESCOPE Ph.D. Thesis
Michael Ray Jacobson 1977 279 p
Avail: Univ. Microfilms Order No. 78-09806

A 0.4 meter aperture, liquid helium cooled multichannel far-infrared balloon-borne telescope was constructed to survey the galactic plane. On its first flight sky background achieved limited performance at 100 microns with a sensitivity of 210 Jy/Hz to the 1/2 power. Nine new sources, above a 3-sigma confidence level of 1300 Jy, were identified. All nine fell within 10 degrees and eight of those within 4 degrees of the galactic equator. Along with data analysis, this thesis consists of an exhaustive description of the instrument, followed by an outline of testing and flight staging procedures. The gondola's performance and improvements since flight are discussed. Ballooning and appendices on strategies for infrared observations through or above the atmosphere and on infrared observations emission mechanisms are included. Dissert. Abstr.

N78-30013 Hawaii Univ., Honolulu.
POLARIMETRY OF Be STARS AT 1.25 AND 2.2 MICRONS Ph.D. Thesis
Terry Jay Jones 1977 104 p
Avail: Univ. Microfilms Order No. 78-10252

Presented are observations of the linear polarization of 8 Be stars at 1.25 and 2.2 microns. An equatorial disk model is developed where the polarization due to electron scattering of stellar and disk radiation is treated discretely, allowing two scatters of the stellar radiation and one of the disk radiation. Neutral hydrogen opacity is taken into account and the populations of the levels of hydrogen are allowed to depart from LTE if the dilute and diffuse fields indicate such a departure is necessary. Dissert. Abstr.

N78-30014 Columbia Univ., New York.
PHOTOHYDRODYNAMIC STABILITY NEAR THE EDDINGTON LIMIT Ph.D. Thesis
Christopher John Marzec 1978 143 p
Avail: Univ. Microfilms Order No. 78-11143

A linearized stability calculation is presented for hot stellar atmosphere models near the Eddington limit. The unperturbed models are plane-parallel atmospheres in hydrostatic and radiative equilibrium, fully ionized, with effective temperatures in excess of 30,000 K. Coherent electron scattering is significant in all models and dominant in models whose luminosity is near the critical Eddington luminosity L sub c. The types of modes observed are described. No convective modes are found. The growth rate is examined, for each of the three sorts of opacity used, in a four dimensional parameter space. Except when extremely unphysical opacities are used, all models show damping, for all L/L sub c values less than unity. Dissert. Abstr.

N78-30015 California Univ., Santa Cruz.
OBSERVATIONS AND ANALYSIS OF Fe 2 EMISSION IN SEYFERT 1 GALAXIES AND QSOs Ph.D. Thesis
Mark Monroe Phillips 1977 203 p
Avail: Univ. Microfilms Order No. 78-11547

Spectrophotometric observations of nineteen Seyfert 1 galaxies and four quasi-stellar objects with strong Fe 2 emission are presented. Relative emission-line intensities, equivalent widths, and continuum slopes were measured for each object. Analysis of the continuum and emission-line data (excluding Fe 2) indicates that densities Ne = 10 to the 7th power and temperatures T = 5000 - 20000 K likely characterize the broad-line regions. The relative intensities of the Fe 2 10 to the 9th power/cu cm lines are very similar from object to object, indicating that the same physical conditions and excitation mechanism are responsible for the emission. Optically-thin resonance fluorescence and collisional excitation models were calculated. Dissert. Abstr.

N78-30016 California Inst. of Tech., Pasadena.
OBSERVATIONS OF THREE BINARY X-RAY SOURCES: CYG X-1, CYG X-2, AND 4U1813+50 (AM HER) Ph.D. Thesis
William Charles Priedhorsky 1978 160 p
Avail: Univ. Microfilms Order No. 7810784

A large-area, rocket-borne pointed proportional counter observation of Cygnus X-1 was made to study its spectrum from 0.15 to 20 keV, and to investigate the possible energy dependence of its shot-noise variability. Extensive optical multicolor photometric observations of the X-ray binary AM Her were made. The data obtained suggest that the red component of the optical flux is closely related to the source of optical circular polarization in the system. It was concluded from the periodic modulation of flux in the U through R bands, that the primary and secondary minima are neither eclipses by a secondary star nor by a hot spot. It is suggested that the primary minimum in the visual light curve is the eclipse of a region of intense optical emission in the magnetic field near the surface of a degenerate dwarf by that dwarf itself. Dissert. Abstr.

N78-30017 California Inst. of Tech., Pasadena.
INFRARED STUDIES OF TWO DARK CLOUDS Ph.D. Thesis
Jonathan Hart Elias 1978 132 p
Avail: Univ. Microfilms Order No. 78-10781

The IC5146 dark cloud complex was surveyed in the infrared in order to identify and study associated young stellar objects. Most of the objects detected in the survey appear to be field stars, predominantly late type giants. Three young objects were detected in the survey. Two of these are examined in detail, and an attempt to produce reasonable models is made. Photometry of the brighter stars in the IC5146 cluster were used to establish a distance to the cluster of 900 + or - 100 pc. A near-infrared survey was also conducted of nearly 18 square degrees of the Ophiuchus dark cloud complex. Additional observations were made of selected objects found in this survey and of the brighter objects found in this region, in order to identify and study the young stars associated with the cloud. Dissert. Abstr.

N78-30018*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG-TERM STUDIES WITH THE ARIEL-5 ASM. 1: HER X-1, VELA X-1 AND CEN X-3
S. S. Holt, L. J. Kaluzienski, E. A. Boldt, and P. J. Serlemitsos Jul. 1978 22 p refs Submitted for publication
(NASA-TM-79605) Avail: NTIS HC A02/MF A01 CSCL 03A

Twelve hundred days of 3-6 keV X-ray data from Her X-1, Vela X-1 and Cen X-3 accumulated with the Ariel-5 all-sky monitor are interrogated. The binary periodicities of all three can be clearly observed, as can the approximately 35-d variation of Her X-1, for which we can refine the period to 34.875 plus or minus .030-d. No such longer-term periodicity less than 200-d is observed from Vela X-1. The 26.6-d low-state recurrence period for Cen X-3 previously suggested is not observed, but a 43.0-d candidate periodicity is found which may be consistent with the precession of an accretion disk in that system. The present results are illustrative of the long-term studies which can be performed on approximately 50 sources over a temporal base which will ultimately extend to at least 1800 days. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-30019 California Univ., Santa Cruz.
THE CHEMICAL COMPOSITION OF GALACTIC AND EXTRAGALACTIC H II REGIONS Ph.D. Thesis
Steven Alan Hawley 1977 85 p
Avail: Univ. Microfilms Order No. 78-11552

A spectrophotometric survey of fifteen galactic H II regions was conducted. From the observed line intensities in the spectral region lambda lambda 3700 to 7100 electron densities, temperatures, and abundances of helium, oxygen, nitrogen, sulfur, and neon are computed. The oxygen and nitrogen abundances are found to correlate with the distance of the H II regions from the galactic center in much the same manner as was proposed previously for other galaxies. New observations of H II regions in M 101 allow the estimate of abundance gradients and a comparison with abundance gradients in the galaxy. Generally, the magnitudes of the various gradients agree although there is some evidence for a steeper nitrogen gradient in the galaxy. The absolute abundances in H II regions in M 101 are probably not different from abundances in the galactic H II regions in this sample. Dissert. Abstr.

N78-30020 Cornell Univ., Ithaca, N. Y.
A STUDY OF NEUTRAL HYDROGEN IN EARLY-TYPE GALAXIES IN THE VIRGO CLUSTER Ph.D. Thesis
Nathan Allyn Krumm 1978 196 p
Avail: Univ. Microfilms Order No. 78-09808

The 21 cm spectral line of neutral hydrogen (HI) was measured for a large sample of elliptical, lenticular, and spiral galaxies with known redshift velocity in a rectangle of the sky including the Virgo cluster. The average detection limit is 2 x 10 to the 8th power M circle dot of HI (point source), or a column density of 6 x 10 to the 19th power atoms/sq cm (uniform, extended source). Sixteen of the 81 galaxies of the rectangle were detected. Two additional galaxies were detected outside the rectangle. Sixteen detection galaxies were mapped. Edge-on galaxies were observed at 1.9 arcmin spacings along their major axes; face-on galaxies were observed in a cross of points. Total hydrogen masses are derived along with systemic velocities, and total profile widths. A simple method is developed for deconvolving the beamshape from the raw data, and HI diameters are determined. Rotation curves are measured for five galaxies.
Dissert. Abstr.

N78-30021 Columbia Univ., New York.
THE GALACTIC DISTRIBUTION OF CARBON MONOXIDE: AN OUT-OF-PLANE SURVEY Ph.D. Thesis
Richard Stuart Cohen 1978 136 p
Avail: Univ. Microfilms Order No. 7809895

Galactic CO line emission at 115 GHz was surveyed in the region 15 deg less than l less than 60 deg and -1.5 deg less than or similar to b less than or similar to 1.5 deg using the Columbian 4 foot telescope (HPBW 8 arc minutes). This survey confirms the findings of previous in-phase studies that CO is concentrated in a ring 6 kpc in radius. It provides the first determination of the thickness of this molecular ring as a function of galactic radius and shows that CO is displaced from the conventional galactic plane. These data were arrived at by least squares fitting the survey data to a circularly symmetric model of the Galaxy. A detailed discussion of the antenna characteristics, including the radiation pattern and pointing characteristics is presented. Dissert. Abstr.

N78-30022*# Michigan Univ., Ann Arbor.
ANALYTIC THEORY OF ORBIT CONTRACTION
Nguyen X. Vinh, James M. Longuski, Adolph Busemann (Colorado Univ., Boulder), and Robert D. Culp (Colorado Univ., Boulder) [1977] 41 p refs
(Grant NsG-1448)
(NASA-CR-157359) Avail: NTIS HC A03/MF A01 CSCL 03B

The motion of a satellite in orbit, subject to atmospheric force and the motion of a reentry vehicle are governed by gravitational and aerodynamic forces. This suggests the derivation of a uniform set of equations applicable to both cases. For the case of satellite motion, by a proper transformation and by the method of averaging, a technique appropriate for long duration flight, the classical nonlinear differential equation describing the contraction of the major axis is derived. A rigorous analytic solution is used to integrate this equation with a high degree of accuracy, using Poincare's method of small parameters and Lagrange's expansion to explicitly express the major axis as a function of the eccentricity. The solution is uniformly valid for moderate and small eccentricities. For highly eccentric orbits, the asymptotic equation is derived directly from the general equation. Numerical solutions were generated to display the accuracy of the analytic theory. A.R.H.

N78-30023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY MAGNETIC HOLES: THEORY
L. F. Burlaga and J. F. Lemaire (Inst. D'Aeronomie Spatiale De Belgique, Brussels, Belgium) Jul. 1978 24 p refs Submitted for publication
(NASA-TM-79599) Avail: NTIS HC A02/MF A01 CSCL 03B

Magnetic holes in the interplanetary medium are explained as stationary, non-propagating, equilibrium structures in which there are field-aligned enhancements of the plasma density and/or temperature. Magnetic anti-holes are considered to be associated with depressions in the plasma pressure. In this model, the observed changes in the magnetic field intensity and direction are due to diamagnetic currents that are carried by ions which drift in a sheath as the result of gradients in the magnetic field and in the plasma pressure within the sheath. The thickness of the sheaths considered is approximately a few ion Larmor radii. An electric field is normal to the magnetic field in the sheath. Solutions of Vlasov's equation and Maxwell's equations are presented which account for several types of magnetic holes, including null-sheets, that were observed. L.S.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-30024 Massachusetts Univ., Amherst.
LIGHT SCATTERING FROM SATURN'S RINGS CALCULATED BY A MARKOV CHAIN FORMALISM Ph.D. Thesis
Larry Wayne Esposito 1978 109 p
Avail: Univ. Microfilms Order No. 78-10711

The theory of Markov chains is used to formulate the radiative transfer problem in a general way by modeling the successive interactions of a photon as a stochastic process. The speed and accuracy of this formalism have been verified for the standard problem of finding the intensity of scattered light from a homogeneous plane-parallel atmosphere with an arbitrary phase function for scattering. Accurate results over a wide range of parameters were obtained with computation times comparable to those of a standard doubling routine. The generality of this formalism may thus allow fast, direct solutions to problems previously soluble only by Monte Carlo methods. Observations are presented of phase curves for both rings in four colors for Saturn's 1977 opposition and linear and logarithmic fits are made to the data. Dissert. Abstr.

N78-30025* National Aeronautics and Space Administration, Washington, D. C.
ATLAS OF MERCURY
Merton E. Davies, ed. (Rand Corp.), Stephen E. Dornik, ed., Donald E. Gault, ed. (NASA. Ames Res. Center), and Robert G. Strom, ed. (Arizona Univ.) 1978 135 p refs
(NASA-SP-423) Avail: NTIS MF A01; HC SOD CSCL 03B

The Mariner 10 spacecraft, its scientific mission, and surface mapping techniques are described as well as the topographic

features of the planet Mercury as photographed by television cameras during three flyby encounters. Shaded relief maps and a computer generated photomosaic of 9 of the 15 cartographic regions are presented. Subsequent material in the atlas includes enlargements of portions of the photomosaics, individual high resolution pictures, mosaics of small areas, and stereo pairs located within the boundaries of the cartographic regions. Footprint locations of individual pictures and stereo pairs are plotted on the shaded relief maps. Current values of the more important orbital and physical properties of Mercury are presented in tables. A.R.H.

N78-30026*# Maryland Univ., College Park.
ORGANIC MOLECULES IN THE ATMOSPHERE OF JUPITER Final Report
C. A. Ponnamperuma [1978] 2 p
(Contract NAS5-20834)
(NASA-CR-156793) Avail: NTIS HC A02/MF A01 CSCL 03B

Organic synthesis in the primitive solar system was simulated by Fischer Tropsch type experiments. Particular attention was given to the formation of lower molecular weight hydrocarbons. In a gas flow experiment, a gas mixture of H2 and CO was introduced into a heated reaction tube at a constant flow rate and passed through a catalyst (powdered Canyon Diablo). The products that emerged were directly analyzed by gas chromatography. The results of 21 runs under various gas mixing rations, reaction temperatures, and gas-catalyst contact times showed the predominance of the saturated hydrocarbon formation at C sub 4 and C sub 5 over the unsaturated ones. Saturate/unsaturate ratios were mostly less than 0.4 and none showed over 0.7. A.R.H.

N78-30027*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW INVERSION METHOD FOR REMOTE SOUNDING OF PLANETARY ATMOSPHERES
Mian M. Abbas (Maryland Univ., College Park, Md.) Jul. 1978 32 p refs Submitted for publication
(Grant NGL-21-002-033)
(NASA-TM-79604) Avail: NTIS HC A03/MF A01 CSCL 03B

An inversion method which is applicable to high resolution observations where the spectral lines are fully resolved is described. The technique is based on matching calculated slopes of the spectral line profiles with slopes of the observed lineshapes, and involves finding an inverse solution to the derivative of the radiative transfer equation with respect to frequency. The method is applied to inversion of ozone absorption lines in the earth's atmosphere and the results are compared with those obtained by a conventional method. Advantages include narrower weighting functions providing a higher vertical resolution; higher atmospheric level which may be probed, more faster and more stable convergence, and more accurate retrieved profiles. A.R.H.

N78-30028*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
[LUNAR BRECCIAS, PETROLOGY, AND EARTH PLANETARY STRUCTURE] Final Technical Report, 1 Feb. 1974 - 1 Feb. 1978
W. Ian Ridley 14 Jul. 1978 307 p refs
(Grant NGR-33-008-199)
(NASA-CR-157361) Avail: NTIS HC A14/MF A01 CSCL 03B

Topics covered include: (1) petrologic studies of poikiloblastic textured rocks; (2) petrology of aluminous mare basalts in breccia 14063; (3) petrology of Apollo 15 breccia 15459; (4) high-alumina mare basalts; (5) some petrological aspects of imbrium stratigraphy; (6) petrology of lunar rocks and implication to lunar evolution; (7) the crystallization trends of spinels in Tertiary basalts from Rhum and Muck and their petrogenetic significance; (8) the geology and evolution of the Cayman Trench; (9) The petrochemistry of igneous rocks from the Cayman Trench and the Captains Bay Pluton, Unalaska Island and their relation to tectonic processes at plate margins; and (10) the oxide and silicate mineral chemistry of a Kimberlite from the Premier Mine with implications for the evolution of kimberlitic magma. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-30029# Boston Univ., Mass. Dept. of Astronomy.
THE RADIO SPECTRUM OF CORONAL HOLE 1
Fred L. Wefer and Michael D. Papagiannis Dec. 1977 24 p refs
(Contract F19628-77-C-0189)
(AD-A051138; Ser-3-No-65; Scientific-1) Avail: NTIS HC A02/MF A01 CSCL 03/2

In an effort to determine the spectral characteristics of radio features associated with coronal holes, radioheliograms obtained at five different wavelengths during the period 25 June through 02 July 1973 were analyzed. X-ray pictures of the sun give the position of Coronal Hole 1 (CH1) on the solar disk during this period. Scans at the same solar latitude (40 N) of the maps were used to reduce the radio spectrum of CH1. These scans showed also a westward displacement of the radio hole relative to the X-ray hole which is a not-well-understood effect that requires further study. Radio data at wavelengths ranging from 2.8 cm to 3.75 m obtained by other observers on subsequent disk passages of CH1 seem to fit reasonably well into the radio spectrum of H1 deduced from the 28 June 1973 radio maps analyzed in this report. GRA

N78-30030# Air Force Geophysics Lab., Hanscom AFB, Mass.
SOLAR TERRESTRIAL PHYSICS DATA EXCHANGE Interim Report
M. A. Shea 14 Apr. 1978 9 p refs Reprinted from Geophys. in the Americas: A Symp. of the Geophys. Comm. of the Pan Am. Inst. of Geography and Hist., Ottawa, Sep. 1976 p 143-150
(AF Proj. 2311)
(AD-A054101; AFGL-TR-78-0091) Avail: NTIS HC A02/MF A01 CSCL 03/2

A description of the solar-terrestrial physics scientific data exchange and information systems operated by the World Data Centers is presented. This includes a brief history of the data center system, a listing of the various types of data archived and disseminated and a summary of relevant publications of World Data Center A for Solar-Terrestrial Physics. Author (GRA)

N78-30031# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 402, FEBRUARY 1978. PART 1: PROMPT REPORTS. DATA FOR JANUARY 1978 - DECEMBER 1977
Helen E. Coffey Feb. 1978 134 p 3 Vol.
(PB-280731/1; SGD-402-Pt-1; NOAA-78032404) Avail: NTIS HC A07/MF A01 CSCL 03B

This prompt report provides data for January 1978 on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, spacecraft observations, inferred IP magnetic field polarities, mean solar magnetic field and solar wind measurements. It also provides data for December 1977 on: daily solar activity center, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N78-30032# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 402, FEBRUARY 1978. PART 2: COMPREHENSIVE REPORTS. DATA FOR AUGUST - JULY 1977 AND MISCELLANEA
Helen E. Coffey Feb. 1978 69 p 3 Vol.
(PB-280732/9; SGD-402-Pt-2; NOAA-78032405) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report for August 1977, July 1977 and miscellaneous data provides data on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, spectral observations Weissenau, cosmic rays and solar X-ray radiation. GRA

N78-30033# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 402, FEBRUARY 1978. SUPPLEMENT: EXPLANATION OF DATA REPORTS
Feb. 1978 92 p 3 Vol.
(PB-280733/7; SGD-402-SUPPL; NOAA-78032406) Avail: NTIS HC A05/MF A01 CSCL 03B

This supplement contains the description and explanation of the data in the monthly publication, Solar-Geophysical Data, compiled by the National Geophysical and Solar Terrestrial Data Center (NGSDC) in Boulder, Colorado, USA. Solar-Geophysical Data is intended to keep research workers abreast on a timely schedule of the major particulars of solar activity and the associated interplanetary, ionospheric, radio propagation and other geophysical effects. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-30034 Minnesota Univ., Minneapolis.
AN EXPERIMENTAL STUDY OF THE CHEMICAL COMPOSITION OF THE HEAVY COSMIC RAY NUCLEI Ph.D. Thesis
Wendell Robert Scarlett 1977 162 p
Avail: Univ. Microfilms Order No. 78-09738

A large area, light weight electronic particle telescope was flown on a high altitude balloon in the summer of 1974 to study the heavy nuclei in the cosmic radiation. This telescope was flown in a configuration having a geometric factor of 0.45 sq m sr and observed some 30,000 nuclei with Z greater than or equal to 12 in an 11 hour exposure. The response and sensitivity of this telescope are discussed in detail. Measurements of the charge spectrum of the cosmic rays having kinetic energy at the top of the atmosphere, t greater than or equal to 650 Mev/AMU and charge 12 less than or equal to Z less than or equal to 28, and of the energy spectra of the Fe nuclei and of the spallation secondaries of Fe are presented and compared with the results of other experiments. Dissert. Abstr.

N78-30035*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY SPECTRUM OF MEDIUM ENERGY GAMMA-RAYS FROM THE GALACTIC CENTER REGION
R. A. R. Palmeira (Inst. de Pesquisas Espaciais), K. RamanujaRao (Inst. de Pesquisas Espaciais), S. L. G. Dutra (Inst. de Pesquisas Espaciais), D. L. Bertsch, D. A. Kniffen, and D. J. Morris (Md. Univ., College Park) Apr. 1978 23 p refs
(NASA-TM-78331; INPE-1218-PE/122) Avail: NTIS HC A02/MF A01 CSCL 03B

A balloon-borne magnetic core digitized spark chamber with two assemblies of spark-chambers above and below the scintillation counters was used to measure the medium energy gamma ray flux from the galactic center region. Gamma ray calculations are based on the multiple scattering of the pair electrons in 15 aluminum plates interleaved in the spark chamber modules. Counting rates determined during ascent and at ceiling indicate the presence of diffuse component in this energy range. Preliminary results give an integral flux between 15 and 70 MeV compared to the differential points in other results. A.R.H.

N78-30036*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FABRICATION OF LIGHT GUIDES FOR ASTROPHYSICS EXPERIMENTS
Stuart E. Tull Apr. 1978 25 p
(NASA-TM-78099) Avail: NTIS HC A02/MF A01 CSCL 03B

The fabrication techniques and procedures utilized in the preparation of isochronal irregular shaped light guides for astrophysics experiments are described. G.Y.

N78-30037*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ANNIHILATION OF GALACTIC POSITRONS
R. Bussard and Reuven Rematy Jul. 1978 24 p refs Submitted for publication
(NASA-TM-79600) Avail: NTIS HC A02/MF A01 CSCL 03B

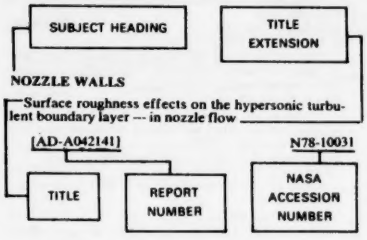
The probabilities of various channels of galactic positron annihilation were evaluated and the spectrum of the resulting radiation was calculated. The narrow width (FWHM less than 3.2 keV) of the 0.511 MeV line observed from the galactic center implies that a large fraction of positrons should annihilate in a medium of temperature less than 100,000 K and ionization fraction greater than 0.05. HII regions at the galactic center could be possible sites of annihilation. A.R.H.

99 GENERAL

No abstracts in this category.

SUBJECT INDEX

Typical Subject Index Listing



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A

ABERRATION
Primary aberrations for grazing incidence
N78-29900

ABRASION RESISTANCE
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215

ABSORPTION SPECTRA
A new inversion method for remote sounding of planetary atmospheres --- spectral lines
[NASA-TM-79604] N78-30027

ABSORPTION SPECTROSCOPY
Non-flame atomic absorption spectroscopy employing a wire loop atomizer
N78-29166
Measurement of small concentrations of pollutants in gases by an optical ac wavelength scanning method
[DLR-IB-453-78/1] N78-29196

ABSORPTIVITY
Experimental study of gas absorption into turbulent falling films of low surface tension liquids
N78-29395
Remote sensing of the earth's atmosphere by the use of radiation from ozone, oxygen and water vapor
N78-29530

ACCELEROMETERS
Storage reliability of missile materiel program, accelerometer analysis
[AD-A053412] N78-29477

ACCURACY
The accuracy of aspiration thermometers
[KNMI-WR-78-1] N78-29430
Modifications to the accuracy assessment analysis routine MLTCRP to produce an output file
[NASA-CR-151811] N78-29794

ACIDITY
Active sites of dealuminated hydrogen mordenite
N78-29179

ACOUSTIC MEASUREMENTS
Flow instability and acoustic radiation measurements of low Reynolds number supersonic jets
N78-29065
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-1] N78-29867
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 2 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-2] N78-29868
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 3 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-3] N78-29869
On estimating the sound radiation of large radial ventilators from acoustic measurements at a model test stand
[DLR-IB-257-77/2] N78-29878

ACRYLIC RESINS
Interaction of water with hydrophilic methacrylate polymers
N78-29244

ACTIVATED CARBON
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654

ACTIVATED SLUDGE
Sources and characteristics of soluable organic nitrogen in activated-sludge effluents
N78-29991

ACTIVATION ENERGY
On the possibility of negative activation energies in bimolecular reactions
[NASA-TM-78509] N78-29149
Collisional stabilization of chemically activated molecules --- cyclic hydrocarbons
N78-29891

ADAPTIVE CONTROL
Bandwidth limitations on achievable cancellation for adaptive nulling systems
[AD-A054160] N78-29326

ADAPTIVE FILTERS
The time-sequenced adaptive filter
N78-29343

ADHESION
Adhesion of electrolytic zinc to aluminum cathodes
[BLL-RTS-10973] N78-29209
Adhesion of gold in ultra-high vacuum
[BLL-PO-TRANS-3555-[7737.47]]
N78-29210
Adhesion of a bimetallic interface --- for Al, Mg, and Zn
[NASA-TM-78890] N78-29214

ADHESIVE BONDING
Fracture mechanics for structural adhesive bonds
[AD-A054023] N78-29509

ADHESIVES
High performance composites and adhesives for V/STOL aircraft
[AD-A054637] N78-29154

ADSORPTION
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654

AERATION
Aeration of sewage lagoons, reservoirs, and streams. Citations from the NTIS data base
[NTIS/PS-78/0433/9] N78-30000

AERIAL PHOTOGRAPHY
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] N78-29529

AERIAL RECONNAISSANCE
Advanced Multispectral Scanner [AMS] study --- aircraft remote sensing
[NASA-CR-151753] N78-29424

AEROACOUSTICS
An investigation of rotor noise generation by aerodynamic disturbance --- aeroacoustic transfer functions
[NASA-CR-157571] N78-29870

AEROBES
Stabilization ponds: Operations manual
[PB-279443/6] N78-30005

AERODYNAMIC CHARACTERISTICS
Advanced aerodynamics and active controls technology
N78-29047
Experimental results of winglets on first, second, and third generation jet transports --- to reduce drag coefficient
N78-29048
Winglet and long duct nacelle aerodynamic development for DC-10 derivatives
N78-29049
Advanced aerodynamics and active controls for a next generation transport
N78-29052
Wind tunnel investigation of computationally optimized variable camber wing configurations
[NASA-TM-78479] N78-29067
Core compressor exit stage study. Volume 1: Blading design --- turbofan engines
[NASA-CR-135391] N78-29099
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-1] N78-29867
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 2 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-2] N78-29868
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 3 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-3] N78-29869

AERODYNAMIC CONFIGURATIONS
A theoretical investigation of ground effects on USB configurations
[NASA-CR-157355] N78-29086

AERODYNAMIC DRAG
Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068

AERODYNAMIC FORCES
Calculation of pressure distribution, forces and moments for the fighter configuration IAe 60 by panel method
[DLR-IB-151-77/13] N78-29072

AERODYNAMIC INTERFERENCE
Calculation of the interference between civil-military transport aircraft engine and basis wing according to the vortex conductor procedure
[DLR-IB-151-77/19] N78-29075

AERODYNAMIC LOADS
Application of winglets and/or wing tip extensions with active load control on the Boeing 747
N78-29050
Development and flight evaluation of active controls in the L-1011 --- including wing load alleviation and stability augmentation
N78-29051
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity --- rotor precession in steam turbines
[BLL-CE-TRANS-7083-[9022.09]]
N78-29066
Investigation of the unsteady airloads on wing-store configurations in subsonic flow
[NLR-MP-77025-U] N78-29073

AERODYNAMIC NOISE
The prediction of aerodynamic and wheel/rail noise generated by high-speed trains
[DLR-IB-257-77/14] N78-29877

AERODYNAMIC STABILITY
Development and flight evaluation of active controls in the L-1011 --- including wing load alleviation and stability augmentation
N78-29051

AEROELASTICITY
Effect of chordwise forces and deformations and deformations due to steady lift on wing flutter
[AD-A053640] N78-29110

AERONAUTICAL ENGINEERING
A method for the analysis of the benefits and costs for aeronautical research and technology
N78-29060

AEROSOLS
A factor model of urban aerosol pollution: A new method of source identification
N78-29625
Aerodynamic particle size measurement by laser-Doppler velocimetry
N78-29627
Regional air pollution study: Fugitive dust survey and inventory
[PB-279706/6] N78-29649
Houston urban plume study: 1974, description and data
[PB-279409/7] N78-29658

AEROSPACE ENGINEERING
Weldbraze airframe components
[AD-A054042] N78-29457
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering --- problem solving methods at the University of Houston
[NASA-CR-157364] N78-29820
AEROSPACE ENVIRONMENTS
Design of space-type electronic power transformers
[NASA-CR-134992] N78-29353
AEROSPACE MEDICINE
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
AEROSPACE SCIENCES
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering --- problem solving methods at the University of Houston
[NASA-CR-157364] N78-29820
AEROSPACE TECHNOLOGY TRANSFER
A critical review of the state of foreign space technology
[NASA-CR-157363] N78-29118
AFTERBURNING
Flame efficiency, stabilization and performance in prevaporizing/premixing combustors
[AD-A053635] N78-29184
AGING [MATERIALS]
Study of the ageing effects of styrene copolymers
[BLL-PO-TRANS-3502-[7737.47]] N78-29242
Testing the stability of high-density polyethylene --- oxidation resistance, weathering, and durability
[BLL-PO-TRANS-3564-[7737.47]] N78-29243
AGRICULTURE
Evaluation of wavelength groups for discrimination of agricultural cover types --- remote sensing of environment in INDIANA
[NASA-CR-157393] N78-29536
Solar radiation and its agricultural utilization on the hillsides of northeast Brazil
[INPE-1005-TPT/049] N78-29542
Utility of agricultural weather services in the mid-South
[PB-280943/2] N78-29711
NOAA climate program --- climate effects on agriculture, energy consumption and fishery production
[PB-281195/8] N78-29712
AGROMETEOROLOGY
The effect of wind and dew point on vegetative wetting duration
[PB-280041/5] N78-29708
The value of improved forecasts of climate for agricultural decision making
[PB-279452/7] N78-29713
AIR
Development of an iron-air battery system for electric vehicles
[TID-27914] N78-29604
AIR BREATHING ENGINES
Proceedings of the Workshop on Engine-Airframe Integration Short-Haul Aircraft
[AD-A053417] N78-29088
AIR CONDITIONING
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
AIR FILTERS
Tests of fabric filtration materials
[PB-279637/3] N78-29648
AIR FLOW
On the maintenance of Walker circulation
[INPE-1260-PE/136] N78-29666
AIR POLLUTION
Proceedings of the Conference on Environmental Chemistry of Hydrazine Fuels
[AD-A054194] N78-29261
Desulfurization of coal and petroleum, volume 2. A bibliography with abstracts
[NTIS/PS-78/0497/4] N78-29270
A factor model of urban aerosol pollution: A new method of source identification N78-29625
Studies of air pollution effects on vegetation
[UCID-17714] N78-29634
Tradescantia stamen hair: An introduction to the system and its use as a monitor atmospheric pollutants
[BNL-23829] N78-29635
MAP3S: Studying the transport, transformation, and fate of atmospheric energy-related pollutants. Addendum: Projected listings for FY 1977
[DOE/EV-0008/2] N78-29636
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 2: Technical discussion
[PB-279636/5] N78-29639
Mercury pollution, volume 1. A bibliography with abstracts
[NTIS/PS-78/0479/2] N78-29642
Mercury pollution, volume 2. A bibliography with abstracts
[NTIS/PS-78/0480/0] N78-29643
US/USSR Symposium on Particulate Control [second]
[PB-279625/8] N78-29644
Regional air pollution study: Fugitive dust survey and inventory
[PB-279706/6] N78-29649
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654
St. Louis demonstration: Power plant equipment, facilities and environmental evaluations
[PB-279828/8] N78-29655
Evaluation of three industrial particulate scrubbers
[PB-279572/2] N78-29656
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657
Houston urban plume study: 1974, description and data
[PB-279409/7] N78-29658
AIR QUALITY
The air quality and oil spill implications of Alaskan oil importation into Southern California N78-29626
The 1977 NRL air quality data
[AD-A054634] N78-29631
Tests of fabric filtration materials
[PB-279637/3] N78-29648
AIR SAMPLING
Evaluation of a technique for sampling low concentrations of organic vapors in ambient air
[PB-279672/0] N78-29652
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657
AIR TRANSPORTATION
CTOL Transport Technology, 1978 --- conferences
[NASA-CP-2036-PT-2] N78-29046
Studies of advanced transport aircraft N78-29064
Demand modelling of passenger air travel: An analysis and extension. Volume 1: Background and summary
[NASA-CR-157469] N78-29076
AIR WATER INTERACTIONS
Scientific and technical publication of the Environmental Research Laboratories: Fiscal year 1976 [1 July 1975 through 30 September 1976]
[PB-280786/5] N78-29983
AIRBORNE/SPACEBORNE COMPUTERS
IRAS on-board software
[NLR-MP-77037-U] N78-29138
AIRCRAFT ACCIDENT INVESTIGATION
Preliminary design of an accident Information Retrieval System [AIRS] --- using microprocessors for data storage in military helicopters
[HSER-7342] N78-29974
AIRCRAFT ACCIDENTS
Overview of safety research N78-29054
AIRCRAFT CARRIERS
Development of corrosion resistant fastening systems for aircraft carrier steam catapults
[AD-A053656] N78-29112
AIRCRAFT CONSTRUCTION MATERIALS
Heavy lift helicopter - advanced technology component program - rotor blade
[AD-A053423] N78-29089
Corrosion fatigue of high strength aircraft structural materials - crystallographic dependence of fracture path in Al-Zn-Mg [7075] alloys
[AD-A053743] N78-29221
AIRCRAFT CONTROL
Advanced aerodynamics and active controls technology N78-29047
Development and flight evaluation of active controls in the L-1011 --- including wing load alleviation and stability augmentation N78-29051
Advanced aerodynamics and active controls for a next generation transport N78-29052
Active controls technology to maximize structural efficiency N78-29053
AIRCRAFT DESIGN
CTOL Transport Technology, 1978 --- conferences
[NASA-CP-2036-PT-2] N78-29046
Advanced aerodynamics and active controls technology N78-29047
Experimental results of winglets on first, second, and third generation jet transports --- to reduce drag coefficient N78-29048
Progress in supersonic cruise aircraft technology N78-29062
General aviation airplane structural crashworthiness user's manual. Volume 2: Input-output, techniques and applications
[AD-A054317] N78-29084
General aviation airplane structural crashworthiness user's manual. Volume 3: Related design information
[AD-A054266] N78-29085
Assessment of service load experience using AIDS-recorded data
[NLR-MP-77011-U] N78-29096
AIRCRAFT ENGINES
Calculation of the interference between civil-military transport aircraft engine and basis wing according to the vortex conductor procedure
[DLR-IB-151-77/19] N78-29075
Effect of air temperature and relative humidity at various fuel-air ratios on exhaust emissions on a per-mode basis of an AVCO Lycoming 0-320 diad light aircraft engine: Volume 1: Results and plotted data
[NASA-TM-73507-VOL-1] N78-29100
Effect of steady flight loads on JT9D-7 performance deterioration
[NASA-CR-135407] N78-29105
Nuclear Bi-Brayton system for aircraft propulsion study
[AD-A054672] N78-29106
Tapered roller bearing development for aircraft turbine engines
[AD-A054045] N78-29458
AIRCRAFT EQUIPMENT
High performance composites and adhesives for V/STOL aircraft
[AD-A054637] N78-29154
AIRCRAFT FUELS
Progress on coal-derived fuels for aviation systems N78-29063
AIRCRAFT HAZARDS
Aircraft hazard detection and control utilizing an aircraft data acquisition system
[AD-A054416] N78-29092
AIRCRAFT INDUSTRY
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082
Civil helicopter design and operational requirement
[NASA-CR-145377] N78-29083
AIRCRAFT LANDING
Wake vortex technology N78-29055
Simulation and analysis of wind shear hazard --- for aircraft landing and takeoff
[NASA-CR-157470] N78-29699
AIRCRAFT MANEUVERS
Verbal prescriptive rules in cognitive pretraining for the vertical S-A training maneuver
[AD-A050971] N78-29749
AIRCRAFT NOISE
Noise prediction technology for CTOL aircraft N78-29057
AIRCRAFT PERFORMANCE
Aircraft military utility and functional tests
[AD-A053617] N78-29091
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
AIRCRAFT SAFETY
Overview of safety research N78-29054
AIRCRAFT STRUCTURES
Active controls technology to maximize structural efficiency N78-29053
AIRCRAFT WAKES
Wake vortex technology N78-29055
AIRFOILS
Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068
AIRFRAMES
Technology transfer and other public policy implications of multi-national arrangements for the production of commercial airframes
[NASA-CR-159890] N78-29045
Proceedings of the Workshop on Engine-Airframe Integration Short-Haul Aircraft
[AD-A053417] N78-29088
Weldbraze airframe components
[AD-A054042] N78-29457
AIRLINE OPERATIONS
Estimating airline operating costs N78-29059

AIRPORT PLANNING
Model environmental impact statement no. 2 for Freedom Airport, Southeast, America
[AD-A049300] N78-29629
AIRPORTS
Wake vortex technology
N78-29055
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
Airport development: Social and economic effects. A bibliography with abstracts
[NTIS/PS-78/0447/9] N78-29114
Model environmental impact statement no. 1, Bicentennial International Airport, Northeast, America
[AD-A049171] N78-29628
ALANINE
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals --- l-alanine, triglycine sulfate, and 3-hydroxyanthine
N78-29935
ALASKA
The air quality and oil spill implications of Alaskan oil importation into Southern California
N78-29626
ALGEBRA
The geometry of differentiable functions on closed subsets of Euclidean space
N78-29857
ALGORITHMS
Search and differentiation algorithms and information theory applied to chemical spectroscopic and biochemical data
N78-29169
Optimization techniques in designing relational database systems
N78-29770
Efficient matrix transposition with limited high speed storage
[FOA-B-30021-E1] N78-29790
ARPANET routing algorithm improvements
[AD-A053450] N78-29796
Convergence properties of a PIES-type algorithm for non-integrable functions
[AD-A053440] N78-29824
Large change sensitivity figure and new algorithm for its minimization
[R-9-77] N78-29856
ALIGNMENT
Non Hookean behavior in the fiber direction of carbon fiber composites and the influence of fiber waviness on the tensile properties
[VTH-LR-251] N78-29157
ALIPHATIC COMPOUNDS
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Data and recommendations
[NPL-CHEM-79] N78-29193
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Fitting and correlation
[NPL-CHEM-80] N78-29194
A method for the estimation of the critical temperatures of alkanols
[NPL-CHEM-81] N78-29195
ALLOYS
Densities of states and spectral weight functions for disordered systems
N78-29939
ALPHANUMERIC CHARACTERS
The design of an optimum alphanumeric symbol set for cockpit displays
[AD-A053447] N78-29097
ALTERNATING CURRENT
On calculation of alternating current switching processes and pulse distortion in narrowband systems
[BLL-RTS-10557] N78-29337
ALTIMETERS
The GEOS-3 orbit determination investigation
[NASA-CR-141441] N78-29127
ALTITUDE
Procedures to accomplish quality control of meteorological altitude data
[INPE-1037-NTE/089] N78-29700
ALTITUDE SICKNESS
Altitude decompression sickness: Review of concepts in primary care
[AD-A050849] N78-29737
ALUMINUM
Adhesion of electrolytic zinc to aluminum cathodes
[BLL-RTS-10973] N78-29209
Adhesion of a bimetallic interface --- for Al, Mg, and Zn
[NASA-TM-78890] N78-29214
ALUMINUM ALLOYS
Methanation activity of Raney nickel catalysts: Effect of proportion of NiAAl3 and Ni2Al3 in precursor alloys
[PB-279636/3] N78-29198
Dynamic strain aging behavior and its impact on tensile and creep deformation of Ti-5Al-2.5Sn
N78-29202
Electronic structure of equiatomic alloys of aluminum with iron, cobalt and nickel
N78-29212
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215
The effects of microstructural features on the response of aluminum alloys to cyclic deformation
[AD-A053649] N78-29220
Thin film corrosion of anodized high-strength aluminum alloys
[AD-A054424] N78-29224
Repair machining and inspection of cracked components
[NLR-MP-77018-U] N78-29483
Microscopic study of stress corrosion crack growth in an AlZnMg alloy
[NLR-MP-77004-U] N78-29518
Fatigue testing of transversely loaded aluminium lugs, sequence 2
[FFA-TN-HU-1848] N78-29522
ALUMINUM BOROHYDRIDES
Design of impact-resistant boron/aluminum large fan blade
[NASA-CR-135417] N78-29104
ALUMINUM GALLIUM ARSENIDES
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
ALUMINUM OXIDES
Methods of fabricating ceramic materials
[AD-A054043] N78-29252
High resolution masks for ion milling pores through substrates of biological interest
[NASA-CR-135435] N78-29276
Test and evaluation of an aluminum oxide ball and seat in a ball valve
[MERC/RI-77/3] N78-29461
AMBERLITE (TRADEMARK)
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water --- using Amberlite ion exchange resins to trap oily pollutants in water
[AD-A053652] N78-29997
AMBIPOLAR DIFFUSION
Anomalous ion loss by low frequency instabilities
[IPPJ-334] N78-29913
AMINES
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Data and recommendations
[NPL-CHEM-79] N78-29193
AMORPHOUS MATERIALS
The structure of amorphous hydrous erbium oxide gels
N78-29173
AMPLIFIERS
Prototype maser amplifiers for three milimeter wavelength
N78-29434
AMPLITUDE DISTRIBUTION ANALYSIS
Amplitude scintillations on earth-space propagation paths at 2 and 30 GHz
[NASA-CR-156785] N78-29307
ANALOG CIRCUITS
Modelling the static current-voltage functions of transistors on analogue computers, with reference to the GF 126 transistor as an example
[BLL-RTS-10955] N78-29339
ANALOG COMPUTERS
Modelling the static current-voltage functions of transistors on analogue computers, with reference to the GF 126 transistor as an example
[BLL-RTS-10955] N78-29339
Analog and digital computer simulation of Coulomb friction
[PB-279465/9] N78-29467
ANALOG TO DIGITAL CONVERTERS
Investigating mapping techniques for elucidating processes occurring in pyrotechnic flames and their flame analogs
[AD-A053373] N78-29260
ANALYSIS (MATHEMATICS)
Hydrodynamic theories of relaxation in liquids
N78-29393
An energy method for analyzing wave propagation in viscous flow in an elastic tube surrounded by an elastic medium
N78-29399
ANCHORS (FASTENERS)
Strength and behavior of anchor bolts embedded near edges of concrete piers
[PB-279376/8] N78-29278
ANELASTICITY
Relaxation of third order elastic constants in crystals with point defects --- thermodynamics of nonlinear anelastic relaxation
N78-29943
ANGLE OF ATTACK
A preliminary method for calculating the aerodynamic characteristics of cruciform missiles to high angles of attack including effects of roll angle and control deflections
[AD-A054349] N78-29070
ANIONS
Anion exchange of 58 elements in hydrobromic acid and in hydriodic acid
[LA-7084] N78-29191
ANNEALING
A phase insensitive ultrasonic transducer --- annealing cadmium sulfide crystals
[NASA-CASE-LAR-12304-1] N78-29871
Annealing studies of beryllium in gallium arsenide and gallium arsenide phosphide
N78-29940
ANNULAR NOZZLES
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-1] N78-29867
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 2 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-2] N78-29868
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 3 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-3] N78-29869
ANODES
Lithium-boron alloy anodes for molten salt batteries, I
[AD-A053621] N78-29587
The electrical and optical properties of the system TiO[2-x]. The electrical, optical and photoconducting properties of Fe[2-x]Cr[x]Ob [o less than or equal to x less than or equal to 0.047]
[AD-A053858] N78-29961
ANTARCTIC REGIONS
Some elements of iceberg technology
[AD-A053431] N78-29679
ANTENNA ARRAYS
Dipole array on a transmission line
[AD-A054315] N78-29370
ANTENNA DESIGN
Microstrip back-fire antenna
[NASA-CASE-LAR-12172-1] N78-29310
Phased arrays, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0331/5] N78-29386
Phased arrays. Citations from the engineering index data base
[NTIS/PS-78/0332/3] N78-29387
ANTENNAS
Advanced microwave radiometer antenna system study
[NASA-CR-156776] N78-29304
Microstrip back-fire antenna
[NASA-CASE-LAR-12172-1] N78-29310
SHF terminal/antenna study, tasks 7 and 8
[AD-A054703] N78-29325
Computer aided EMC analysis - a review of available tools
[NLR-TR-77070-U] N78-29331
The apparent resistance of aerials
[BLL-PO-TRANS-3538-[7737.47]] N78-29341
APPLICATIONS OF MATHEMATICS
Stability properties of a nonlinear differential system in applied mathematics
[CTH-MATH-1977-15] N78-29865
APPROXIMATION
The application of diffusion approximations to the study of time-sharing computers and transitory queueing systems
[AD-A054313] N78-29812
Adaptive piecewise polynomial L1 approximation
[AD-A053651] N78-29822
Approximation of convex set-valued functions
[AD-A054541] N78-29861
AQUEOUS SOLUTIONS
Determination of particle size distribution of salt crystals in aqueous slurries
[RHO-SA-5] N78-29192
Interaction of water with hydrophilic methacrylate polymers
N78-29244
AQUIFERS
Simulation of saturated and unsaturated deformable porous media --- flow distribution and displacement in aquifiers
N78-29404
ARC MELTING
Comparison of the microstructure and mechanical properties of 300-M steel manufactured by the vacuum arc remelt and the electroslag remelt processes
[LBL-6686] N78-29226
ARCTIC REGIONS
Nansen-Drift Station Project: Remote sea-ice runway construction
[AD-A054720] N78-29113
ARGON LASERS
Determination of temperature and differential scattering cross-sections from rotational Raman scattering of laser radiation at 488.0 nm
[NPL-QU-43] N78-29447
ARIEL SATELLITES
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3 --- periodic variations
[NASA-TM-79605] N78-30018

ARKANSAS
Utility of agricultural weather services in the mid-South
[PB-280943/2] N78-29711
ARMATURES
On the width of the commutation zone of direct current electrical machines with smooth-core armatures
[BLL-RTS-10633] N78-29338
ARMOR
Effect of spot and stud welding on ESR 4340 steel armor
[AD-A054025] N78-29455
Automatic control of weld penetration
[AD-A054026] N78-29456
ARRAYS
KITCHIP: A superior low power monolithic device array
N78-29345
ARTIFICIAL SATELLITES
The construction of thermospheric density correction tables for use in satellite trajectory and lifetime predictions
[AD-A054341] N78-29129
ASPECT RATIO
A preliminary method for calculating the aerodynamic characteristics of cruciform missiles to high angles of attack including effects of roll angle and control deflections
[AD-A054349] N78-29070
ASPHALT
Analysis of full depth AC pavements using layered elastic theory
[PB-279386/7] N78-29291
ASTRONOMICAL TELESCOPES
Far-infrared photometry with an 0.4-meter liquid helium cooled balloon-borne telescope
N78-30012
ASYMPTOTIC METHODS
A low-frequency limitation of FACT
[AD-A054371] N78-29875
ATLANTIC OCEAN
Variability of water temperature in the Atlantic near the equator --- GARP Atlantic Tropical Experiment
[BLLD-M-24959-[5828.4F]] N78-29717
ATMOSPHERIC ATTENUATION
Molecular and particulate extinction in the atmosphere between 8 and 15 micrometers wavelength
[PB-280773/3] N78-29695
ATMOSPHERIC CHEMISTRY
MAP3S: Studying the transport, transformation, and fate of atmospheric energy-related pollutants. Addendum: Projected listings for FY 1977
[DOE/EV-0008/2] N78-29636
ATMOSPHERIC CIRCULATION
An investigation of the growth and decay of long and synoptic-scale waves
N78-29294
On the maintenance of Walker circulation
[INPE-1260-PE/136] N78-29666
Dynamics of stratospheric winds in the Southern Hemisphere
[INPE-1065-PE/064] N78-29670
Diagnostic model of extratropical perturbation studies
[INPE-1108-PE/082] N78-29671
ATMOSPHERIC CLOUD PHYSICS LAB [SPACELAB]
Modification of the continuous flow diffusion chamber for use in zero-gravity --- atmospheric cloud physics lab
[NASA-CR-150765] N78-29123
ATMOSPHERIC COMPOSITION
Air chemistry measurements in the lower atmosphere made from a small aircraft - data presentation
[AC-42] N78-29692
A new inversion method for remote sounding of planetary atmospheres --- spectral lines
[NASA-TM-79604] N78-30027
ATMOSPHERIC DENSITY
The construction of thermospheric density correction tables for use in satellite trajectory and lifetime predictions
[AD-A054341] N78-29129
ATMOSPHERIC EFFECTS
Scientific and technical publication of the Environmental Research Laboratories: Fiscal year 1976 [1 July 1975 through 30 September 1976]
[PB-280786/5] N78-29983
ATMOSPHERIC ELECTRICITY
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
Exploratory Meeting on Atmospheric Electricity and Severe Storms
[NASA-CP-2056] N78-29669
ATMOSPHERIC IONIZATION
The RIAR system, a new telecommunication system. High-altitude, artificially-ionised regions. Possible extension to VHF, UHF and SHF telecommunication
[RAE-LIB-TRANS-1968] N78-29311
ATMOSPHERIC MODELS
Diagnostic model of extratropical perturbation studies
[INPE-1108-PE/082] N78-29671
BENCHMARK-76: Model computations for disturbed atmospheric conditions. 3: Results for selected excitation parameters at 60 km
[AD-A054376] N78-29682
BENCHMARK-76: Model computations for disturbed atmospheric conditions II. Results for the stratosphere and mesosphere
[AD-A054325] N78-29684
Atmospheric prediction model survey
[NASA-CR-157217] N78-29697
Severe storms: Prediction, detection, and warning. A report of the Panel on Shortrange Prediction and the Panel on Severe Storms to the Committee on Atmospheric Sciences Assembly of Mathematical and Physical Sciences.
[PB-279306/5] N78-29715
Photohydrodynamic stability near the Eddington limit
N78-30014
ATMOSPHERIC PHYSICS
Physical properties of design atmospheres
[ESDU-78008] N78-29660
ATMOSPHERIC PRESSURE
Hot corrosion and oxidation studies on cobalt-based alloys
[AD-A053745] N78-29222
ATMOSPHERIC TEMPERATURE
Effect of air temperature and relative humidity at various fuel-air ratios on exhaust emissions on a per-mode basis of an AVCO Lycoming 0-320 diad light aircraft engine: Volume 1: Results and plotted data
[NASA-TM-73507-VOL-1] N78-29100
Determination of temperature and differential scattering cross-sections from rotational Raman scattering of laser radiation at 488.0 nm
[NPL-QU-43] N78-29447
Heating and cooling degree days for Tennessee
[PB-280740/2] N78-29709
Probability of low and high temperatures in Tennessee
[PB-280741/0] N78-29710
ATOMIC COLLISIONS
Selected topics from the theory of electron-atom and atom-atom collisions
N78-29885
ATOMIC ENERGY LEVELS
Investigation of the triplet states of chlorophylls
[COO-2570-3] N78-29151
ATOMIC EXCITATIONS
Use of operator equation of motion techniques in treating collective excitations
N78-29942
ATOMIC STRUCTURE
Electronic structure of equiatomic alloys of aluminum with iron, cobalt and nickel
N78-29212
ATOMIZERS
Non-flame atomic absorption spectroscopy employing a wire loop atomizer
N78-29166
Computer assisted characterization of a filament electrothermal atomizer
N78-29168
ATS 5
A compendium of millimeter wave propagation studies performed by NASA
[NASA-CR-156781] N78-29309
ATS 6
A compendium of millimeter wave propagation studies performed by NASA
[NASA-CR-156781] N78-29309
ATTACKING [ASSAULTING]
Pilot workload analysis based upon in-flight physiological measurements and task analysis methods
[NLR-MP-76001-U] N78-29762
ATTENUATION COEFFICIENTS
Ultrasonic attenuation as a function of heat treatment and grain size in 79Ni6Mo-15Fe alloy
[SAND-78-0144] N78-29280
AUDITORY DEFECTS
Foreign noise research in noise effects. A survey of foreign noise effects research
[PB-279383/4] N78-29650
AUDITORY PERCEPTION
The apparent rate of flicker
[NHK-LABS-NOTE-219] N78-29748
AUDITORY SIGNALS
The frequency following response in humans
N78-29734
AURORAL ELECTROJETS
Geomagnetic data for April 1978: AE [8] indices and stacked magnetograms
[PB-280730/3] N78-29696
AURORAS
Nonlinear analysis of plasma instability excited by the auroral electrojet
[AD-A053647] N78-29678
AUTOCORRELATION
Time series in M dimensions: Autoregressive models
[AD-A054586] N78-29851
AUTOMATA THEORY
Succinctness of descriptions of context-free, regular and finite languages
N78-29788
Toward a theory of probabilistic automata with environments
[AD-A053986] N78-29811
AUTOMATIC CONTROL
Computer assisted characterization of a filament electrothermal atomizer
N78-29168
AUTOMATION
Semiconductor measurement technology: Automated photomask inspection --- used in fabrication of integrated circuits
[PB-279336/2] N78-29488
AUTOMOBILE ENGINES
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449
AUTOMOBILE FUELS
Methanol as a possible fuel for automotive use
[TT-7708] N78-29259
AUTOMOBILES
Evaluation of rollover procedures: 45 Degree dolly rollovers
[PB-279392/5] N78-29468
AUXILIARY PROPULSION
Engineering model 8-cm thruster subsystem
[NASA-CR-135406] N78-29147
AVALANCHE DIODES
Electrooptical devices
[AD-A054477] N78-29907
AVIONICS
Avionics planning guidance: Executive summary
[AD-A054719] N78-29098
Integrated guidance, navigation and control verification plan primary flight system --- space shuttle avionics integration
[NASA-CR-151815] N78-29144
AXISYMMETRIC BODIES
An exact velocity potential solution of steady, compressible flow over arbitrary two-dimensional and axisymmetric bodies in simply connected fields
[AD-A054462] N78-29415
AXISYMMETRIC FLOW
Laws for the structure of turbulence of axisymmetrical jets in an accompanying current
[BLLD-M-25563-[5828.4F]] N78-29401

B

BACKFIRE
Microstrip back-fire antenna
[NASA-CASE-LAR-12172-1] N78-29310
BALL BEARINGS
Wear tests with PTFE-bearings at varying loads
[FFA-TN-HU-1755] N78-29462
BALLOON-BORNE INSTRUMENTS
Far-infrared photometry with an 0.4-meter liquid helium cooled balloon-borne telescope
N78-30012
BAND STRUCTURE OF SOLIDS
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
BANDPASS FILTERS
Synthesis of bandpass signals through the minimum number of samples
[R-5-77] N78-29330
BANDWIDTH
Bandwidth limitations on achievable cancellation for adaptive nulling systems
[AD-A054160] N78-29326
Computation of the irregularity-factor N sub o/N sub i of a stationary Gaussian process with dual peak power spectral density
[TB-137] N78-29501
BARIUM
Lifetimes of excited states of barium and lanthanum and the modification of the Hanle effect by strong optical pumping
N78-29884
BARS
The deformation of steel bars in a four-point bending machine, measured by holographic interferometry
[NPL-MOM-27] N78-29517
BATHS
A temperature controlled water bath for viscosity measurement
[NPL-MOM-24] N78-29281
BEAM SPLITTERS
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902

BEAMS [RADIATION]
Focused laser beam scattering by stationary and moving particles: A theoretical study
N78-29433
BEAMS [SUPPORTS]
Finite elements for the elastic analysis of composite beams and bridges
N78-29496
Inelastic bending of beams under time-varying moments: A state variable approach
[COO-2733-15] N78-29511
BEARINGS
Finite element analysis of rotor-bearing systems with matrix reduction
N78-29492
BENDING
Determination of bending stresses in a spur gear tooth
[RAE-LIB-TRANS-1923] N78-29452
The deformation of steel bars in a four-point bending machine, measured by holographic interferometry
[NPL-MOM-27] N78-29517
BENZENE
Linear polybenzyl derivatives
N78-29239
BERYLLIUM
Electron-beam fusion welding of beryllium
[RFP-2621] N78-29459
Annealing studies of beryllium in gallium arsenide and gallium arsenide phosphide
N78-29940
Polarimetry of Be stars at 1.25 and 2.2 microns
N78-30013
BIBLIOGRAPHIES
Bibliography and comments on Loran-C ground wave propagation
[PB-279463/4] N78-29079
Airport development: Social and economic effects. A bibliography with abstracts
[NTIS/PS-78/0447/9] N78-29114
Pipeline corrosion. Citations from the NTIS data base
[NTIS/PS-78/0453/7] N78-29229
Pipeline corrosion, volume 1. Citations from the engineering index data base
[NTIS/PS-78/0454/5-VOL-1] N78-29230
Pipeline corrosion, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0455/2-VOL-2] N78-29231
Tin plating and tin plate. Citations from the NTIS data base
[NTIS/PS-78/0477/6] N78-29232
Tin plating and tin plate. Citations from the engineering index data base
[NTIS/PS-78/0478/4] N78-29233
Chemical analysis of steel. A bibliography with abstracts
[NTIS/PS-78/0491/7] N78-29235
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the NTIS data base
[NTIS/PS-78/0499/0] N78-29266
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the American Petroleum Waste Institute data base
[NTIS/PS-78/0500/5] N78-29267
Underground coal gasification. Citations from the NTIS data base
[NTIS/PS-78/0485/9] N78-29268
Underground coal gasification. Citations from the engineering index data base
[NTIS/PS-78/0486/7] N78-29269
Desulfurization of coal and petroleum, volume 2. A bibliography with abstracts
[NTIS/PS-78/0497/4] N78-29270
Coal tar technology. A bibliography with abstracts
[NTIS/PS-78/0407/3] N78-29271
Electronic countermeasures and electronic counter countermeasures, volume 1. A bibliography with abstracts
[NTIS/PS-78/0336/4] N78-29332
Electronic countermeasures and electronic counter countermeasures, volume 2: A bibliography with abstracts
[NTIS/PS-78/0337/2] N78-29333
Microwave oscillators. Citations from the engineering index data base
[NTIS/PS-78/0334/9] N78-29385
Phased arrays, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0331/5] N78-29386
Phased arrays. Citations from the engineering index data base
[NTIS/PS-78/0332/3] N78-29387
Gunn effect and transferred electron devices, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0361/2] N78-29388
Gunn effect devices, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0362/0] N78-29389
Phase shifters. Citations from the engineering data base
[NTIS/PS-78/0471/9] N78-29390
Phase shifters, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0469/3-VOL-2] N78-29391
Phase shifters, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0470/1] N78-29392
Infrared techniques for nondestructive testing. Citations from the NTIS data base
[NTIS/PS-78/0358/8] N78-29484
Infrared techniques for nondestructive testing. Citations from the engineering index data base
[NTIS/PS-78/0359/6] N78-29485
Reliability: Mathematical techniques, volume 1. A bibliography with abstracts
[NTIS/PS-78/0438/8] N78-29486
Reliability: Mathematical techniques, volume 2. A bibliography with abstracts
[NTIS/PS-78/0439/6] N78-29487
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0423/0] N78-29551
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0424/8] N78-29552
Energy conservation through building design. Citations from the NTIS data base
[NTIS/PS-78/0444/6] N78-29615
Energy conservation through building design. Citations from the engineering index data base
[NTIS/PS-78/0445/3] N78-29616
Energy conservation: Buildings, volume 1. A bibliography with abstracts
[NTIS/PS-78/0502/1] N78-29617
Energy conservation: Buildings, volume 2. A bibliography with abstracts
[NTIS/PS-78/0503/9] N78-29618
Mercury pollution, volume 1. A bibliography with abstracts
[NTIS/PS-78/0479/2] N78-29642
Mercury pollution, volume 2. A bibliography with abstracts
[NTIS/PS-78/0480/0] N78-29643
Biological effects of mercury pollution. A bibliography with abstracts
[NTIS/PS-78/0496/6] N78-29651
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[PB-279528/4] N78-29693
Biological effects of microwaves. A bibliography with abstracts
[NTIS/PS-78/0432/1] N78-29745
Simulators in education and training, volume 2. A bibliography with abstracts
[NTIS/PS-78/0378/6] N78-29752
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[NTIS/PS-78/0379/4] N78-29753
Ultrasonics in medicine. Citations from the NTIS data base
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Ultrasonics in medicine, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0495/8] N78-29880
Use of ultrasonics in manufacturing procedures. A bibliography with abstracts
[NTIS/PS-78/0483/4] N78-29881
Machine translation. A bibliography with abstracts
[NTIS/PS-78/0448/7] N78-29977
Walsh functions. A bibliography with abstracts
[NTIS/PS-78/0508/8] N78-29978
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information --- organizations and information sources for technology utilization in developing countries
[PB-279193/7] N78-29981
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[PB-280786/5] N78-29983
Economic models, volume 3. A bibliography with abstracts
[NTIS/PS-78/0440/4] N78-29987
Aeration of sewage lagoons, reservoirs, and streams. Citations from the engineering index data base
[NTIS/PS-78/0434/7] N78-29999
Aeration of sewage lagoons, reservoirs, and streams. Citations from the NTIS data base
[NTIS/PS-78/0433/9] N78-30000
BIMETALS
Adhesion of a bimetallic interface --- for Al, Mg, and Zn
[NASA-TM-78890] N78-29214
Electrical response of a bimetallic junction to shock compression
[AD-A053693] N78-29362
BINARY MIXTURES
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Data and recommendations
[NPL-CHEM-79] N78-29193
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Fitting and correlation
[NPL-CHEM-80] N78-29194
Packing, sintering and blending of binary powder mixtures
N78-29207
BINARY STARS
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH
[NASA-CR-157356] N78-29539
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3 --- periodic variations
[NASA-TM-79605] N78-30018
BINARY SYSTEMS [MATERIALS]
The kinetics of two-phase emulsion polymerization
N78-29236
Contributions to the theory of generalized block designs
N78-29854
BIOCHEMISTRY
Search and differentiation algorithms and information theory applied to chemical spectroscopic and biochemical data
N78-29169
BIODEGRADATION
Biodegradation of shipboard wastewater in collection, holding, and transfer tanks
[AD-A053643] N78-29726
BIOINSTRUMENTATION
Bioelectrodes as sensors and as power sources for implantable medical devices
[BMFT-FB-T-77-44] N78-29736
Ultrasonics in medicine. Citations from the NTIS data base
[NTIS/PS-78/0494/1] N78-29879
Ultrasonics in medicine, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0495/8] N78-29880
BIOLOGICAL EFFECTS
Biological effects of mercury pollution. A bibliography with abstracts
[NTIS/PS-78/0496/6] N78-29651
Medical and biologic effects of environmental pollutants platinum-group metals
[PB-279464/2] N78-29659
Study of effects of space power satellites on life support functions of the earth's magnetosphere
[NASA-CR-156948] N78-29674
Influence of microwaves within the thermal intensity range in mice. Weight, rectal temperature, respiration, tread mill activity, reaction of senses, and learning
[FOA-C-54018-H2/H6] N78-29730
Topical hazard evaluation program of candidate insect repellent AI3-36331, US Department of Agriculture propriety compound
[AD-A054216] N78-29741
Biological effects of microwaves. A bibliography with abstracts
[NTIS/PS-78/0432/1] N78-29745
BEIRMOD, a computer program for calculating the effects of exposure to ionizing radiation
[PB-279584/7] N78-29747
BIOSATELLITES
Support of ASTP/KOSMOS fundulus embryo development experiment
[NASA-CR-151816] N78-29724
BIOTELEMETRY
KITCHIP: A superior low power monolithic device array
N78-29345
BLACK HOLES [ASTRONOMY]
Interplanetary magnetic holes: Theory
[NASA-TM-79599] N78-30023
BLOCK DIAGRAMS
Contributions to the theory of generalized block designs
N78-29854
BLOOD CIRCULATION
Solid-state ultrasonic catheter-tip flowmeter
[AD-A050963] N78-29740
BODIES OF REVOLUTION
Interactive computer methods for calculating geometrical and inertial properties of general shaped areas and volumes of revolution
N78-29764
BODY CENTERED CUBIC LATTICES
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955
BODY-WING CONFIGURATIONS
A study of the lift-to-drag ratio capability of caret wing waveriders
[AD-A053691] N78-29069
BOEING 747 AIRCRAFT
Application of winglets and/or wing tip extensions with active load control on the Boeing 747
N78-29050
Assessment of service load experience using AIDS-recorded data
[NLR-MP-77011-U] N78-29096
BOILERS
Design and testing of a small feedwater pump
[AD-A053646] N78-29453
BOLTS
Strength and behavior of anchor bolts embedded near edges of concrete piers
[PB-279376/8] N78-29278
Torquing preload in a lubricated bolt
[NASA-TM-78501] N78-29451

BOLTZMANN DISTRIBUTION
Kinetic description of interaction of radiation with two- and three-level molecular systems
N78-29883
BONDING
Theoretical and experimental studies of reactivity and bonding of transition-metal organometallic compounds
N78-29201
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 1: Main report
[PB-279512/8] N78-29282
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 2: Appendix
[PB-279513/6] N78-29283
BORON ALLOYS
Lithium-boron alloy anodes for molten salt batteries, I
[AD-A053621] N78-29587
BOROSILICATE GLASS
Electrical properties and structure of BaO-B2O3-SiO2 glass containing titanium ions
N78-29204
BOSONS
Phenomenology of neutral current interactions --- hadrons, bosons, neutrinos and weak energy interactions
N78-29888
BOUNDARY LAYER FLOW
Interpretation of the turbulent flow in the viscous wall region as a driven flow
[AD-A053404] N78-29411
Suppression of perforated wall in a transonic wind tunnel and the effects on aerodynamic data
[AD-A054417] N78-29876
BOUNDARY LAYER SEPARATION
Structure of magnetic field perturbations during the development of unsteady separation in the Tokamak-6 installation
[ORNL-TR-4528] N78-29924
BOUNDARY LAYERS
An optimization study for generating surface-oriented coordinates for arbitrary bodies in high reflow
[AD-A054047] N78-29414
Review of magnetospheric boundary layer phenomena and relations to current theories
[TRITA-EPP-77-25] N78-29691
BOUNDARY VALUE PROBLEMS
In-plane deformation of non-coaxial plastic soil
[AD-A054217] N78-29686
Automatic differentiation of computer programs and a posteriori error bounds for two-point boundary value problems
N78-29786
The edge-function method [E.F.M.]
[AD-A054265] N78-29827
Fast Poisson solvers on general two dimensional regions for the Dirichlet problem
[AD-A054539] N78-29830
A posteriori error bounds for two-point value problems
[AD-A054544] N78-29831
An integral representation for eigenfunctions of linear ordinary differential operators
[AD-A054543] N78-29832
The implementation of implicit Runge-Kutta formulae for the solution of initial-value problems
[NPL-NAC-87] N78-29839
BRAYTON CYCLE
Nuclear Bi-Brayton system for aircraft propulsion study
[AD-A054672] N78-29106
Closed cycle Brayton turbomachinery research
[AD-A053024] N78-29586
BRAZIL
Solar radiation and its agricultural utilization on the hillsides of northeast Brazil
[INPE-1005-TPT/049] N78-29542
Dynamics of stratospheric winds in the Southern Hemisphere
[INPE-1065-PE/064] N78-29670
A methodology to regional planning
[INPE-1263-TPT/087] N78-29967
BRAZING
Weldbraze airframe components
[AD-A054042] N78-29457
BREADBOARD MODELS
Breadboard wash water renovation system --- using ferric chloride and ion exchange resins to remove soap and dissolved salts
[NASA-CR-151818] N78-29993
BREATHING APPARATUS
Respirator studies for the Nuclear Regulatory Commission. Protection Factors for supplied-air respirators
[I.A-7098-PR] N78-29760
BRECCIA
Lunar breccias, petrology, and earth planetary structure
[NASA-CR-157361] N78-30028
BREMSSTRAHLUNG
Energy spectrum of medium energy gamma-rays from the galactic center region --- experimental design
[NASA-TM-78331] N78-30035
BRIDGES [STRUCTURES]
Reinforced elastomers and friction supports: Modern methods of antiseismic support
[SAND-78-6001] N78-29257
The applicability of infrared thermography in the detection of delamination in bridge decks
[PB-279508/6] N78-29285
Finite elements for the elastic analysis of composite beams and bridges
N78-29496
BRINES
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197
Conditioning of geothermal brine effluents for injection: Use of coagulants
[UCID-17716] N78-29609
Brine chemistry and combined heat/mass transfer, volume I
[EPRI-ER-635-VOL-1] N78-29612
BROADCASTING
Hierarchical organization of distributed packet-switching communication systems
N78-29295
BROMIDES
Thermal dynamic properties of NiBr2 and NiSO4 from 10 to 1,200 K
[PB-279646/4] N78-29966
BRONZES
Corrosion fatigue of cast propeller alloys in flowing seawater
[PB-279337/0] N78-29234
BUCKLING
Viscoelastic buckling of shells
[FFA-TN-HU-1911] N78-29523
Nonlinear deformations and static buckling
[ESA-TT-478] N78-29524
BUILDINGS
Detailed application of a technology for the formulation and expression of standards applicable to the American National Standard Building Code requirements for minimum design loads in buildings and other structures [ANSI A58.1-1972]
[PB-279091/3] N78-29289
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
Energy conservation through building design. Citations from the NTIS data base
[NTIS/PS-78/0444/6] N78-29615
Energy conservation through building design. Citations from the engineering index data base
[NTIS/PS-78/0445/3] N78-29616
Energy conservation: Buildings, volume 1. A bibliography with abstracts
[NTIS/PS-78/0502/1] N78-29617
Energy conservation: Buildings, volume 2. A bibliography with abstracts
[NTIS/PS-78/0503/9] N78-29618
Solar demonstrations on Federal residences: Better planning and management control needed
[PB-279485/7] N78-29624
BULKHEADS
Shock induced structural response
[AD-A053877] N78-29507
BUTT JOINTS
Predicted effects of residual stresses on butt weld fatigue life
N78-29494

C

CADMIUM SULFIDES
Properties of spray pyrolysis CdS film and its application to thin film solar cell
N78-29565
A phase insensitive ultrasonic transducer --- annealing cadmium sulfide crystals
[NASA-CASE-LAR-12304-1] N78-29871
CALIBRATING
Calibration and related measurement services of the National Bureau of Standards
[PB-279459/2] N78-29287
Laser Doppler velocity simulator
[NASA-CASE-LAR-12176-1] N78-29435
CALIFORNIA
HCMM: Soil moisture in relation to geologic structure and lithology, Northern California
[E78-10177] N78-29533
California Water Resources Center
[PB-279614/2] N78-29555
Representative industrial solar energy installation, Northridge Hospital, Northridge, California
[UCRL-13789] N78-29613
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657
A local earthquake coda magnitude and its relation to duration, moment M sub O, and local Richter magnitude M sub L
[NASA-CR-157473] N78-29664
CAMBERED WINGS
Wind tunnel investigation of computationally optimized variable camber wing configurations
[NASA-TM-78479] N78-29067
CAMERA SHUTTERS
Modern ultrafast streak camera development and application review
[LA-UR-77-2474] N78-29429
CANADA
Canada report to COSPAR --- university research and space programs in Canada
N78-29126
Retransmission of hydrometric data in Canada
[E78-10174] N78-29531
CANOPIES
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
CAPACITORS
KITCHIP: A superior low power monolithic device array
N78-29345
GAC-ANL TNS scoping studies. Volume 11: TNS doublet Tokamak ohmic-heating power supply study --- Tokamak reactor technology
[GA-A-14614-VOL-11] N78-29919
CAPILLARY TUBES
Mathematical and computational studies of equilibrium capillary free surfaces
[NASA-CR-135345] N78-29408
CARBON
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
CARBON DIOXIDE
TEA laser emission on the sequence bands of CO2
[AD-A054149] N78-29437
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936
CARBON DIOXIDE LASERS
Laser induced vibrational energy transfer and chemical reactions
N78-29431
Laser rangefinder/tank thermal sight integration study
[AD-A054622] N78-29438
Laser-fusion program at Los Alamos
[LA-UR-77-174] N78-29443
CARBON FIBER REINFORCED PLASTICS
Non Hookean behavior in the fiber direction of carbon fiber composites and the influence of fiber waviness on the tensile properties
[VTH-LR-251] N78-29157
Fatigue strength of a fibre-reinforced material
N78-29500
CARBON FIBERS
Coupling agents: HME resin system
[AD-A054394] N78-29153
CARBON MONOXIDE
Stage and development possibilities of the Fischer-Tropsch-Synthesis for the production of primary chemicals and feedstocks
[BMFT-FB-T-77-43] N78-29581
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936
The galactic distribution of carbon monoxide: An out-of-plane survey
N78-30021
CARBONATES
National Fuel Cell Seminar. Program and abstracts
[CONF-770664-ABSTS] N78-29614
CARET WINGS
A study of the lift-to-drag ratio capability of caret wing waveriders
[AD-A053691] N78-29069
CARGO
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-2] N78-29996
CARIBBEAN SEA
Data from the Atlantic Oceanographic and Meteorological Laboratories loop current monitoring cruises May 1975 through August 1976
[PB-280772/5] N78-29721
CASTINGS
An experimental technique for vacuum infiltration of cracks with plastic and subsequent study in the scanning electron microscope
[VTH-LR-249] N78-29521
CATALYSTS
Studies of solid-catalyzed systems subject to catalyst deactivation and diffusional limitations
N78-29176

Methanation activity of Raney nickel catalysts: Effect of proportion of NiAAl3 and Ni2Al3 in precursor alloys
[PB-279656/3] N78-29198
Hydrodesulfurization and liquefaction of a bituminous coal in a batch autoclave with particulate and monolith catalysts
N78-29564
Stage and development possibilities of the Fischer-Tropsch-Synthesis for the production of primary chemicals and feedstocks
[BMFT-FB-T-77-43] N78-29581

CATALYTIC ACTIVITY
Active sites of dealuminated hydrogen mordenite
N78-29179
Evaluation of sulfur-tolerant catalytic processes for producing peak-shaving alcohol fuels
[EPRI-AF-687] N78-29263

CATAPULTS
Development of corrosion resistant fastening systems for aircraft carrier steam catapults
[AD-A053656] N78-29112

CATHETOMETERS
Solid-state ultrasonic catheter-tip flowmeter
[AD-A050963] N78-29740

CATHODES
Adhesion of electrolytic zinc to aluminum cathodes
[BLL-RTS-10973] N78-29209

CAUCHY PROBLEM
Causality and the propagation of relativistic fields
N78-29297

CAVITATION FLOW
Applications of cavitation analysis to design and operation of SPTF-HFL pump loops
[SAN/0700-1] N78-29460

CELLS (BIOLOGY)
SPAR project: Counter current distribution of biologicals
[NASA-CR-150766] N78-29182
Electrophoretic separator for purifying biologicals, part 1
[NASA-CR-150768] N78-29183
Self diffusion in cells and tissues
[AD-A053422] N78-29727

CENTRIFUGAL PUMPS
Investigation on a slow running centrifugal pump at different Reynolds numbers
[BLL-RTS-10585] N78-29402
The behaviour of centrifugal pumps operating with heavy oils
[ME/77/28] N78-29450

CENTRIFUGES
System analysis of plasma centrifuges and sputtering
[NASA-CR-135079] N78-29916

CERAMICS
Substitution of ceramics for high temperature alloys --- advantages of using silicon carbides and silicon nitrides in gas turbine engines
[NASA-TM-78931] N78-29246
High temperature mechanical properties of polyphase ceramics based on silicon nitride
[AD-A054342] N78-29248
Grain boundary energetics in non-oxide ceramics
[AD-A054179] N78-29251
Methods of fabricating ceramic materials
[AD-A054043] N78-29252
Production Engineering Measure [PEM]: Manufacturing methods and technology for piezoelectric transformers
[AD-A054177] N78-29371
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-13] N78-29416
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-14] N78-29417

CHANNEL FLOW
Hierarchical organization of distributed packet-switching communication systems
N78-29295

CHANNELS (DATA TRANSMISSION)
An assigned-slot listen-before-transmission protocol for a multiaccess data channel
N78-29296

CHARACTERIZATION
Development and characterization of analysis methods for control of highly concentrated hydrazine --- rocket propellants
[FOA-C-20213-D3] N78-29264

CHARGE COUPLED DEVICES
Preliminary study of the reliability of imaging charge coupled devices
[NASA-CR-150761] N78-29352
Part 1: A recirculating charge-coupled device. Part 2: The mercury selenide on N-silicon Schottky barrier
N78-29933

CHARGE EXCHANGE
On the possibility of negative activation energies in bimolecular reactions
[NASA-TM-78509] N78-29149

CHARGE TRANSFER
Measurements of selected charge transfer processes at low energies
[AD-A054360] N78-29683

CHARTS
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078

CHECKOUT
Electronic equipment screening and debugging techniques
[AD-A053561] N78-29365

CHELATES
Investigations into the determination of trace levels of iron, Part 1: A field method for the determination of EDTA in natural water
N78-29159

CHEMICAL ANALYSIS
New methods for improving sensitivity in trace analysis
N78-29164
Search and differentiation algorithms and information theory applied to chemical spectroscopic and biochemical data
N78-29169
International Conference on Matrix Isolation Spectroscopy [1st]
[AD-A053579] N78-29186
Chemical analysis of steel. A bibliography with abstracts
[NTIS/PS-78/0491/7] N78-29235
Development and characterization of analysis methods for control of highly concentrated hydrazine --- rocket propellants
[FOA-C-20213-D3] N78-29264
Determination of RDX in UC-36 --- explosives colorimetry
[FOA-C-20216-D1] N78-29265
Technical manual for the analysis
[PB-279196/0] N78-29272
A factor model of urban aerosol pollution: A new method of source identification
N78-29625

CHEMICAL COMPOSITION
Air chemistry measurements in the lower atmosphere made from a small aircraft - data presentation
[AC-42] N78-29692
Toxicological investigation of zinc and titanium smoke compositions. A literature study
[FOA-C-40072-H2] N78-29744
The chemical composition of galactic and extragalactic H II regions
N78-30019
An experimental study of the chemical composition of the heavy cosmic ray nuclei
N78-30034

CHEMICAL PROPERTIES
Brine chemistry and combined heat/mass transfer, volume 1
[EPRI-ER-635-VOL-1] N78-29612

CHEMICAL REACTIONS
Chemical reactions and properties of organosilicon compounds related to new materials
[AD-A053672] N78-29150
Studies in the synthesis of control structures for chemical processes
N78-29162
The high pressure kinetics of a halide exchange reaction
N78-29163
Reactions of yttria-stabilized zirconia with oxides and sulfates of various elements
[NASA-TM-78942] N78-29216
Laser induced vibrational energy transfer and chemical reactions
N78-29431
Stage and development possibilities of the Fischer-Tropsch-Synthesis for the production of primary chemicals and feedstocks
[BMFT-FB-T-77-43] N78-29581

CHEMICAL REACTORS
Stage and development possibilities of the Fischer-Tropsch-Synthesis for the production of primary chemicals and feedstocks
[BMFT-FB-T-77-43] N78-29581

CHEMISORPTION
Selection rule effects in electronic excitations of chemisorbed molecules as studied by energy loss spectroscopy
[AD-A054105] N78-29894
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936

CHILDREN
Analyzing the learning of computer programming concepts through the teaching of PAL
N78-29787

CHINA
Pure and applied mathematics in the People's Republic of China
[PB-279509/4] N78-29840

CHLORINE
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661

CHLOROBENZENES
Application of negative chemical ionization mass spectrometry to the analysis of bovine tissue for chlorodibenzo-p-dioxins and related compounds
N78-29171

CHLOROPHYLLS
Investigation of the triplet states of chlorophylls
[COO-2570-3] N78-29151

CHROMIUM
High temperature irradiation damage in nickel-chromium solid solutions
N78-29203

CHROMIUM ALLOYS
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215
Investigating localized corrosion and sputtering feasibility of amorphous chromium-containing alloys
[AD-A053581] N78-29219

CIRCULATION
Part 1: A recirculating charge-coupled device. Part 2: The mercury selenide on N-silicon Schottky barrier
N78-29933

CITIES
A factor model of urban aerosol pollution: A new method of source identification
N78-29625
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995
Adoption and utilization of urban technology: A decision-making study, analysis and conclusion, part 2
[PB-279541/7] N78-30010

CIVIL AVIATION
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082
Civil helicopter design and operational requirement
[NASA-CR-145377] N78-29083
Simple empirical cost model for aircraft --- fly-away prices for civil and military aircraft
[FOA-C-20205-D8[M4]] N78-29986

CLIMATE
Climate change to the year 2000: A survey of expert opinion
[AD-A054208] N78-29707
Heating and cooling degree days for Tennessee
[PB-280740/2] N78-29709
Probability of low and high temperatures in Tennessee
[PB-280741/0] N78-29710
NOAA climate program --- climate effects on agriculture, energy consumption and fishery production
[PB-281195/8] N78-29712

CLINICAL MEDICINE
Ultrasonics in medicine. Citations from the NTIS data base
[NTIS/PS-78/0494/1] N78-29879
Ultrasonics in medicine, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0495/8] N78-29880

CLOUD CHAMBERS
Modification of the continuous flow diffusion chamber for use in zero-gravity --- atmospheric cloud physics lab
[NASA-CR-150765] N78-29123

CLOUD COVER
The TIROS-N polar orbiting-environmental satellite system
[PB-280743/6] N78-29139

CLOUDS
Infrared studies of two dark clouds
N78-30017

CLOUDS (METEOROLOGY)
Molecular and particulate extinction in the atmosphere between 8 and 15 micrometers wavelength
[PB-280773/3] N78-29695
Evaluation of the FIB methodology for application to cloud motion wind data
[AD-A053620] N78-29703

CLUTTER
Radar-77
[AD-A053624] N78-29314
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328

COAL
Desulfurization of coal and petroleum, volume 2. A bibliography with abstracts
[NTIS/PS-78/0497/4] N78-29270
Coal tar technology. A bibliography with abstracts
[NTIS/PS-78/0407/3] N78-29271
Estimating environmental damages from surface mining of coal in Appalachia: A case study
[PB-279150/7] N78-29553
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
Evaluation of a data base for a 100 MW coal burning power using pressurized fluidized bed combustion
[BMFT-FB-T-77-48] N78-29569

Coal as an energy resource, conflict and consensus
[PB-279539/1] N78-29623

COAL GASIFICATION
Underground coal gasification. Citations from the NTIS data base
[NTIS/PS-78/0485/9] N78-29268
Underground coal gasification. Citations from the engineering index data base
[NTIS/PS-78/0486/7] N78-29269
Low- and medium-Btu gasification systems: Technology overview
[PB-279641/5] N78-29275

COAL LIQUEFACTION
Synthetic oil from coal: The economic impact of five alternatives for making hydrogen from coal
[PB-279322/2] N78-29273
Hydrodesulfurization and liquefaction of a bituminous coal in a batch autoclave with particulate and monolith catalysts
N78-29564
Study of capital requirements, cost estimates and economic analysis of a SRC-II [Solvent Refined Coal] plant under conditions related to the Federal Republic of Germany
[BMFT-FB-T-77-64] N78-29582

COAL UTILIZATION
Progress on coal-derived fuels for aviation systems
N78-29063
Slagging MHD generator: A parametric study
[SAND-77-1951] N78-29608

COASTAL WATER
Coastal upwelling ecosystems analysis. JOINT-II, the Thompson sections: R/V T. G. Thompson cruise 108
[PB-279173/9] N78-29718

COATINGS
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449

COBALT
Experimental studies of interfacial electro chemistry
N78-29158
Electronic structure of equiatomic alloys of aluminum with iron, cobalt and nickel
N78-29212

COBALT ALLOYS
The hardness and deformation of tungsten carbide-cobalt alloys
N78-29211
Hot corrosion and oxidation studies on cobalt-based alloys
[AD-A053745] N78-29222

COCKPITS
The design of an optimum alphanumeric symbol set for cockpit displays
[AD-A053447] N78-29097

CODES
Computer program LK25OT: Power flux calculation and three-pole short circuit current calculation
[DOE-TR-77] N78-29380

CODING
Impairment of picture signals and subjective quality in digital coding: Edge business visibility
[BLL-PO-TRANS-3516-[7737.47]]
N78-29298
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328
Walsh functions. A bibliography with abstracts
[NTIS/PS-78/0508/8] N78-29978

COEFFICIENT OF FRICTION
Skid resistance study
[PB-279588/8] N78-29464

COGNITION
A test of a cognitive model of computer program readability --- human problem solving
N78-29768

COGNITIVE PSYCHOLOGY
A test of a cognitive model of computer program readability --- human problem solving
N78-29768

COHERENT LIGHT
Space-variant coherent optical processing
N78-29901

COHERENT RADIATION
A low-frequency limitation of FACT
[AD-A054371] N78-29875

COLLISION PARAMETERS
Calculations of atomic inner-shell vacancy yields and their dependence on collision parameters
N78-29886
Collisional stabilization of chemically activated molecules --- cyclic hydrocarbons
N78-29891

COLLISIONLESS PLASMAS
Introduction to the kinetic theory of plasma turbulence
[INPE-1196-PE/112] N78-29917

COLORIMETRY
Determination of RDX in UC-36 --- explosives colorimetry
[FOA-C-20216-D1] N78-29265

COMBUSTION
Summary: Workshop on the DOE Combustion Diagnostics Facility
[SAND-77-8287] N78-29591

COMBUSTION CHAMBERS
Mixing and combustion in high speed air flows --- combustor design
[AD-A054398] N78-29188

COMBUSTION PHYSICS
Mathematical theory of laminar combustion. 3: Perturbations
[AD-A054538] N78-29189
Mathematical theory of laminar combustion. 2: The premixed plane flame
[AD-A054537] N78-29190

COMBUSTION PRODUCTS
MAP3S: Studying the transport, transformation, and fate of atmospheric energy-related pollutants. Addendum: Projected listings for FY 1977
[DOE/EV-0008/2] N78-29636
Tests of fabric filtration materials
[PB-279637/3] N78-29648

COMBUSTION STABILITY
Flame efficiency, stabilization and performance in prevaporizing/premixing combustors
[AD-A053635] N78-29184

COMMITTEE ON SPACE RESEARCH
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124
Space research in the Republic of South Africa: Report to COSPAR --- on solar terrestrial physics and satellite remote sensing
N78-29125

COMMUNICATING
A test of a cognitive model of computer program readability --- human problem solving
N78-29768

COMMUNICATION
Digital communications/interoperability techniques
[AD-A053558] N78-29312
Robust parameter estimators for communication data
[AD-A053901] N78-29317

COMMUNICATION NETWORKS
Hierarchical organization of distributed packet-switching communication systems
N78-29295
Considerations for a small economical earth terminal
[AD-A053623] N78-29313
Transparent integrated intelligence network: Response normalization
[AD-A054308] N78-29773

COMMUNICATION SATELLITES
Facsimile communication and electronic mail system by satellite in Iran and other developing nations
N78-29301
Considerations for a small economical earth terminal
[AD-A053623] N78-29313
Skynet SGEMP test program: The skynet satellite as test object
[AD-A054359] N78-29321
Propagation of microwave satellite communication signals through striated media
[AD-A054677] N78-29324
SHF terminal/antenna study, tasks 7 and 8
[AD-A054703] N78-29325

COMMUNICATIONS TECHNOLOGY SATELLITE
Communications Link Characterization Experiment [CLCE]
[NASA-CR-156784] N78-29308
CTS TEP thermal anomalies: Heat pipe system performance
[NASA-CR-159413] N78-29410

COMMUNITIES
Community noise exposure resulting from aircraft operations. Volume 1: Acoustic data on military aircraft
[AD-A053699] N78-29872
Community noise exposure resulting from aircraft operations. Volume 4: Acoustic data on Air Force trainer/fighter aircraft
[AD-A053702] N78-29873

COMMUTATION
On the width of the commutation zone of direct current electrical machines with smooth-core armatures
[BLL-RTS-10633] N78-29338

COMPARISON
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995

COMPILERS
An XPL/ALGOL translator
[INPE-1304-TPT/096] N78-29793
Survey of conversion support software
[AD-A053741] N78-29798

COMPONENT RELIABILITY
Storage reliability of missile materiel program. Storage reliability analysis summary report. Volume 1: Electrical and electronic devices
[AD-A053405] N78-29470
Storage reliability of missile materiel program. Storage reliability summary report. Volume 3: Hydraulic and pneumatic devices
[AD-A053409] N78-29471
Storage reliability of missile materiel program. Storage reliability summary report. Volume 4: Ordnance devices
[AD-A053406] N78-29472
Storage reliability of missile materiel program. Storage reliability summary report. Volume 5: Optical and electro-optical devices
[AD-A053407] N78-29473
Storage reliability of missile materiel program, electronic vacuum tube analysis
[AD-A053402] N78-29474
Storage reliability of missile materiel program. Missile material reliability prediction handbook, parts count prediction
[AD-A053403] N78-29475
Storage reliability of missile materiel program, accelerometer analysis
[AD-A053412] N78-29477

COMPOSITE MATERIALS
High performance composites and adhesives for V/STOL aircraft
[AD-A054637] N78-29154
Diffusion welding multifilament superconductive composites
[UCRL-80436] N78-29156
Kevlar 49-epoxy insulator
[SAND-77-0500] N78-29256
A study of the feasibility of utilizing solid wastes for building materials. Phase 1, summary report
[PB-279440/2] N78-29286
Finite elements for the elastic analysis of composite beams and bridges
N78-29496
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503
Note on the cryostatic stability of superconducting composites --- long wire concept
[ORNL-TM-5989] N78-29962

COMPOSITE STRUCTURES
Current status of composite flywheel development
[UCRL-80604] N78-29605

COMPRESSION LOADS
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503

COMPRESSOR BLADES
Core compressor exit stage study. Volume 1: Blading design --- turbofan engines
[NASA-CR-135391] N78-29099
Computer program for relaxation solutions of the nonlinear small disturbance equations for transonic flow in an axial compressor blade row
[AD-A053744] N78-29412

COMPRESSOR ROTORS
Core compressor exit stage study. Volume 1: Blading design --- turbofan engines
[NASA-CR-135391] N78-29099

COMPUTATION
Decomposition in fixed point computation --- operations research and optimization
[AD-A053439] N78-29797
The computation of immediate texture discrimination
[AD-A053804] N78-29810

COMPUTER GRAPHICS
Object models for computer aided design
N78-29765
A methodology for the ergonomic design of interactive computer graphic systems, and its application to crystallography
N78-29767
General strip chart plotting routine
[AD-A054156] N78-29801

COMPUTER INFORMATION SECURITY
An experiment in database access control
[AD-A054189] N78-29775
Intelligence security subsystem
[AD-A054508] N78-29776

COMPUTER NETWORKS
Peak load pricing of computer network services
N78-29806

COMPUTER PROGRAMMING
Computer aided EMC analysis - a review of available tools
[NLR-TR-77070-U] N78-29331
Planning in interconnected power systems: An example of two-stage programming under uncertainty
[AD-A054554] N78-29376
A useful computer program for LC networks synthesis in time domain
[R-8-77] N78-29382
Function schemata
N78-29785
Analyzing the learning of computer programming concepts through the teaching of PAL
N78-29787
A comparison of the axiomatic and functional models of structured programming
[AD-A053629] N78-29795

Providing computer-based information services to an academic community
[PB-278330/6] N78-29975

COMPUTER PROGRAMS
A preliminary method for calculating the aerodynamic characteristics of cruciform missiles to high angles of attack including effects of roll angle and control deflections
[AD-A054349] N78-29070
General aviation airplane structural crashworthiness user's manual. Volume 2: Input-output, techniques and applications
[AD-A054317] N78-29084
Propulsion/flight control integration technology (PROFIT) software system definition
[NASA-CR-144876] N78-29102
Theoretical analysis of solvent effects on polymer conformation --- polypeptides and the hydration shell theory
N78-29238
Investigating mapping techniques for elucidating processes occurring in pyrotechnic flames and their flame analogs
[AD-A053373] N78-29260
On calculation of alternating current switching processes and pulse distortion in narrowband systems
[BLL-RTS-10557] N78-29337
Computer program LK25OT: Power flux calculation and three-pole short circuit current calculation
[DOE-TR-77] N78-29380
Computer program for relaxation solutions of the nonlinear small disturbance equations for transonic flow in an axial compressor blade row
[AD-A053744] N78-29412
TODEP: A computer program for two dimensional wave propagation problems and deformation processes
[FOA-C-20184-D4] N78-29418
System optimization of gasdynamic lasers, computer program user's manual
[NASA-TM-73193] N78-29436
Handling of fatigue data in computer analysis
N78-29498
Computer module for one step dynamic response of an axisymmetric or plane linear elastic thin shell
[UCID-17730] N78-29512
Program PRESTO: Preparation of reference energy systems through time
[BNL-50723] N78-29594
BEIRMOD, a computer program for calculating the effects of exposure to ionizing radiation
[PB-279584/7] N78-29747
A test of a cognitive model of computer program readability --- human problem solving
N78-29768
The microprocessor INTEL 8080 A and its use as digital filter
[DLR-IB-552-77/22] N78-29779
Development of a laboratory data system executive summary
[PB-279765/2] N78-29782
Automatic differentiation of computer programs and a posteriori error bounds for two-point boundary value problems
N78-29786
Modifications to the accuracy assessment analysis routine SPATL to produce an output file
[NASA-CR-151810] N78-29791
Modifications to the accuracy assessment analysis routine MLTCRP to produce an output file
[NASA-CR-151811] N78-29794
Survey of conversion support software
[AD-A053741] N78-29798
Interactive Digital Receiver Simulator (IDRS) system user's manual and software documentation
[AD-A053684] N78-29799
General strip chart plotting routine
[AD-A054156] N78-29801
General multi-configuration Hartree-Fock program: MCHF77
[COO-4264-1] N78-29805
A stirling engine computer model for performance calculations
[NASA-TM-78884] N78-29994

COMPUTER SYSTEMS DESIGN
A methodology for the ergonomic design of interactive computer graphic systems, and its application to crystallography
N78-29767

COMPUTER SYSTEMS PROGRAMS
IRAS on-board software
[NLR-MP-77037-U] N78-29138
HDM: Command and staff overview
[AD-A054482] N78-29803

COMPUTER TECHNIQUES
Computer assisted cost estimating at Los Alamos Scientific Laboratory
[LA-UR-77-2070] N78-29778
Direct access data migration system
[PB-280074/6] N78-29780
The visibility and impact of electronic storage and delivery of handbook-type information. Volume 1, part 1: Chapters 1-4. Part 2: Chapters 5 and appendices
[PB-278072/4] N78-29976

COMPUTERIZED DESIGN
Design automation and testing of diagnosable MOS combinational logic networks
N78-29344
Interactive computer methods for calculating geometrical and inertial properties of general shaped areas and volumes of revolution
N78-29764
Object models for computer aided design
N78-29765

COMPUTERIZED SIMULATION
Digital simulation of flexible aircraft response to symmetrical and asymmetrical runway roughness
[AD-A053588] N78-29087
HF channel simulator for wide band signals. A mathematical model and computer program for 100-kHz bandwidth HF channels
[AD-A054726] N78-29323
Power system simulator
[AD-A054476] N78-29375
Computer simulation of non-Darcy two-phase flow in oil reservoirs
N78-29405
Computer simulation of the effect of road roughness on tire-pavement forces in braking and cornering
[PB-279887/4] N78-29466
Analog and digital computer simulation of Coulomb friction
[PB-279465/9] N78-29467
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632
Survey of models to predict the effect of geothermal power development on domestic water supplies and to design pollution monitoring methods
[UCRL-79977] N78-29637
Numerical simulation of ionospheric and plasmaspheric dynamics
[AD-A053451] N78-29680
Application of a soil cap model to ground motion analyses
[AD-A053694] N78-29681
Time-domain two-dimensional computer simulation of three-terminal semiconductor devices
[AD-A054287] N78-29800
A general two-dimensional tokamak model
[AD-A054413] N78-29918

CONCENTRATION (COMPOSITION)
Methods for the determination of gases in metals
[FOA-B-20009-D4[F3]] N78-29228
National water quality inventory 1976 report to Congress
[PB-279462/6] N78-29647
Regional air pollution study: Fugitive dust survey and inventory
[PB-279706/6] N78-29649
Evaluation of a technique for sampling low concentrations of organic vapors in ambient air
[PB-279672/0] N78-29652
Concentration susceptibility and the phase diagram of He3-He4 mixtures near the tricritical line
N78-29932
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water --- using Amberlite ion exchange resins to trap oily pollutants in water
[AD-A053652] N78-29997

CONCRETES
Strength and behavior of anchor bolts embedded near edges of concrete piers
[PB-279376/8] N78-29278
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 1: Main report
[PB-279512/8] N78-29282
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 2: Appendix
[PB-279513/6] N78-29283
Design and performance of pavement overlays
[PB-279523/5] N78-29284
Analysis of full depth AC pavements using layered elastic theory
[PB-279386/7] N78-29291
Vibration of unreinforced pavement concrete
[PB-279148/1] N78-29292
Finite element analysis of air pulse wave loaded single thrown concrete plates
[FOA-C-20204-D4[A3]] N78-29516
Computation of tensile stress in prestressed members due to cable restraint during detensioning
[PB-279391/7] N78-29526
Alternate materials of construction for geothermal applications
[BNL-50751] N78-29611

CONFERENCES
CTOL Transport Technology, 1978 --- conferences
[NASA-CP-2036-PT-2] N78-29046
Proceedings of the Workshop on Engine-Airframe Integration Short-Haul Aircraft
[AD-A053417] N78-29088
A critical review of the state of foreign space technology
[NASA-CR-157363] N78-29118
International Conference on Matrix Isolation Spectroscopy [1st]
[AD-A053579] N78-29186
Computer science and technology: Robotics Research Workshop proceedings
[PB-279334/7] N78-29290
Radar-77
[AD-A053624] N78-29314
Watershed Research in Eastern North America. Volume 1: A workshop to compare results
[PB-279919/5] N78-29549
Watershed Research in Eastern North America. Volume 2: A workshop to compare results
[PB-279920/3] N78-29550
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
Coal as an energy resource, conflict and consensus
[PB-279539/1] N78-29623
US/USSR Symposium on Particulate Control [second]
[PB-279625/8] N78-29644
Papers presented to the Conference on Plateau Uplift: Mode and Mechanism
[NASA-CR-157468] N78-29663
Exploratory Meeting on Atmospheric Electricity and Severe Storms
[NASA-CP-2056] N78-29669
Management of Data Elements in Information Processing
[PB-279661/3] N78-29784
Second Topical Conference on High-Temperature Plasma Diagnostics
[LA-7160C] N78-29927
The Second International Conference on the Electronic Properties of 2-Dimensional Systems
[AD-A054419] N78-29960
Water problems in the rural environment: Alternative solutions for water supply and waterwaste disposal
[PB-279775/1] N78-29969
Urban transportation economics: Proceedings of five workshops on pricing alternatives, economic regulations, labor issues, marketing, and government financing responsibilities
[PB-279689/4] N78-30009

CONFIDENCE LIMITS
Confidence limits on MTBF for sequential test plans of MIL-STD 781
[AD-A054588] N78-29482
Overview of the economic theory of uncertainty and its implications for energy supply
[EPRI-EA-586] N78-29599
Incorporating uncertainty in energy supply models
[EPRI-EA-703-VOL-2] N78-29602

CONGRESSIONAL REPORTS
Crop forecasting by satellite: Progress and problems
[PB-279437/8] N78-29561
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978
[PB-279607/6] N78-29971
Timeliness and completeness of FBI responses to requests under freedom of information and privacy acts have improved
[PB-279416/2] N78-29984

CONSERVATION
Municipal and industrial water conservation-the Federal government could do more
[PB-279487/3] N78-29556

CONSERVATION LAWS
Uniqueness of solutions to hyperbolic conservation laws
[AD-A054557] N78-29836

CONSTRAINTS
Powered inertia reel retraction during ejection
[AD-A054157] N78-29077

CONSTRUCTION MATERIALS
Effectiveness of building insulation applications
[AD-A053452] N78-29277
Alternate materials of construction for geothermal applications
[BNL-50751] N78-29611

CONTAMINANTS
Measurement of small concentrations of pollutants in gases by an optical ac wavelength scanning method
[DLR-IB-453-78/1] N78-29196

CONTAMINATION
Experimental investigation of contamination prevention techniques to cryogenic surfaces on board orbiting spacecraft
[NASA-CR-152171] N78-29146

CONTINUUM MECHANICS
Uniqueness of solutions to hyperbolic conservation laws
[AD-A054557] N78-29836

CONTRAILS
Assessment of atmospheric condensation nuclei associated with jet aircraft traffic
[AD-A054319] N78-29705

CONTROL
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
Studies in the synthesis of control structures for chemical processes
N78-29162

CONTROL EQUIPMENT
US/USSR Symposium on Particulate Control [second]
[PB-279625/8] N78-29644
Evaluation of three industrial particulate scrubbers
[PB-279572/2] N78-29656

CONTROL STABILITY
Analytic method for dimensioning absolute stable control systems --- applied to air robots
[FOA-C-20187-E4] N78-29813

CONTROL THEORY
State estimation and optimal control of distributed parameter systems
N78-29177
Singular perturbation of nonlinear regulators and systems with oscillatory modes
N78-29807
Linear equivalences in hereditary control systems
N78-29808

CONTROLLERS
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132

CONVECTIVE FLOW
Heat transfer during transition from film to nucleate boiling of water in force convection upward flow
N78-29398

CONVERGENCE
Convergence properties of a PIES-type algorithm for non-integrable functions
[AD-A053440] N78-29824

CONVEXITY
Approximation of convex set-valued functions
[AD-A054541] N78-29861

COOLING SYSTEMS
Design and installation package for a solar powered pump
[NASA-CR-150740] N78-29570
Energy conservation: Buildings, volume 1. A bibliography with abstracts
[NTIS/PS-78/0502/1] N78-29617
Energy conservation: Buildings, volume 2. A bibliography with abstracts
[NTIS/PS-78/0503/9] N78-29618

CORN
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537

CORNEA
Corneal damage thresholds for infrared laser exposure: Empirical data, model predictions, and safety standards
[AD-A049946] N78-29739

CORRELATION
A study of correlation among error terms of a repeated measures design
N78-29815

CORROSION
Investigating localized corrosion and sputtering feasibility of amorphous chromium-containing alloys
[AD-A053581] N78-29219
Corrosion fatigue of high strength aircraft structural materials - crystallographic dependence of fracture path in Al-Zn-Mg [7075] alloys
[AD-A053743] N78-29221
Pipeline corrosion. Citations from the NTIS data base
[NTIS/PS-78/0453/7] N78-29229
Pipeline corrosion, volume 1. Citations from the engineering index data base
[NTIS/PS-78/0454/5-VOL-1] N78-29230
Pipeline corrosion, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0455/2-VOL-2] N78-29231
Wisconsin test facility ground terminal corrosion study --- inspection of underground electric cables
[AD-A053715] N78-29363

CORROSION RESISTANCE
Development of corrosion resistant fastening systems for aircraft carrier steam catapults
[AD-A053656] N78-29112
Hot corrosion and oxidation studies on cobalt-based alloys
[AD-A053745] N78-29222
Effectiveness of over-rust primer for Naval shore facilities
[AD-A053557] N78-29247

CORROSION TESTS
Thin film corrosion of anodized high-strength aluminum alloys
[AD-A054424] N78-29224

COSMIC RAYS
An experimental study of the chemical composition of the heavy cosmic ray nuclei
N78-30034

COSMOS SATELLITES
Support of ASTP/KOSMOS fundulus embryo development experiment
[NASA-CR-151816] N78-29724

COST ANALYSIS
Disseminating standards of time and frequency: Issues in the evaluation of alternatives systems
[PB-279684/5] N78-29866
Simple empirical cost model for aircraft --- fly-away prices for civil and military aircraft
[FOA-C-20205-D8[M4]] N78-29986

COST EFFECTIVENESS
A method for the analysis of the benefits and costs for aeronautical research and technology
N78-29060
Production Engineering Measure [PEM]: Manufacturing methods and technology for piezoelectric transformers
[AD-A054177] N78-29371
Simple empirical cost model for aircraft --- fly-away prices for civil and military aircraft
[FOA-C-20205-D8[M4]] N78-29986

COST ESTIMATES
Estimating airline operating costs
N78-29059
Study of capital requirements, cost estimates and economic analysis of a SRC-II [Solvent Refined Coal] plant under conditions related to the Federal Republic of Germany
[BMFT-FB-T-77-64] N78-29582
Computer assisted cost estimating at Los Alamos Scientific Laboratory
[LA-UR-77-2070] N78-29778
Peak load pricing of computer network services
N78-29806

COST REDUCTION
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082

COTTON FIBERS
Tests of fabric filtration materials
[PB-279637/3] N78-29648

COULOMB POTENTIAL
High order contributions to the hyperfine structure in positronium and muonium
N78-29887

COUPLING
Coupling of lower hybrid waves in the doublet 2A high power RF heating experiments
[GA-A-14808] N78-29922

COUPLING CIRCUITS
Measurement of the coupling impedance and cross-talk between coaxial conductors
[RAE-LIB-TRANS-1961] N78-29354

COVARIANCE
Some optimal properties and interpretations of principal components
[AD-A054555] N78-29834

CRACK INITIATION
Microscopic study of stress corrosion crack growth in an AlZnMg alloy
[NLR-MP-77004-U] N78-29518
Behaviour of pierced and cracked plates loaded beyond general yield
[CRIF-MT-119] N78-29519

CRACK PROPAGATION
Summary of landing gear initial flaws
[AD-A054048] N78-29095
An ultrasonic pulse-height difference method of recording crack growth over an extended period
[ARL/MAT-NOTE-120] N78-29495
Microscopic study of stress corrosion crack growth in an AlZnMg alloy
[NLR-MP-77004-U] N78-29518
An experimental technique for vacuum infiltration of cracks with plastic and subsequent study in the scanning electron microscope
[VTH-LR-249] N78-29521

CRASHES
General aviation airplane structural crashworthiness user's manual. Volume 2: Input-output, techniques and applications
[AD-A054317] N78-29084
General aviation airplane structural crashworthiness user's manual. Volume 3: Related design information
[AD-A054266] N78-29085

CREEP BUCKLING
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503

CREEP PROPERTIES
Dynamic strain aging behavior and its impact on tensile and creep deformation of Ti-5Al-2.5Sn
N78-29202
Creep of oxide dispersion strengthened materials [with special reference to TD nichrome]
[NASA-CR-135432] N78-29217
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525

CREEP STRENGTH
High temperature mechanical properties of polyphase ceramics based on silicon nitride
[AD-A054342] N78-29248

CRITICAL TEMPERATURE
A method for the estimation of the critical temperatures of alkanols
[NPL-CHEM-81] N78-29195

CRUDE OIL
Computer simulation of non-Darcy two-phase flow in oil reservoirs
N78-29405

CRYOGENIC MAGNETS
Note on the cryostatic stability of superconducting composites --- long wire concept
[ORNL-TM-5989] N78-29962

CRYOGENICS
Experimental investigation of contamination prevention techniques to cryogenic surfaces on board orbiting spacecraft
[NASA-CR-152171] N78-29146

CRYSTAL DEFECTS
Damage profiles in silicon and their impact on device reliability
[AD-A053622] N78-29364
Defect-free epitaxial layers for Si-vidicon targets
[NHK-LABS-NOTE-220] N78-29954

CRYSTAL GROWTH
Ice crystal growth in a dynamic thermal diffusion chamber
N78-29662
The effects of melt-crystal interface temperature rise on the analysis of crystal growth in binary borate glass melts
N78-29948
Solid state formation of Nd:Y sub 3 Al sub 5 O sub 12 Nd YAG
[AD-A054428] N78-29959

CRYSTAL LATTICES
Critical behavior of Reggeon field theory on a lattice --- using Hamiltonian formalism
N78-29944

CRYSTAL OSCILLATORS
Manufacturing Methods and Technology Engineering [MM and TE] program for the establishment of production techniques for high density thick film circuits used in crystal oscillators
[AD-A054562] N78-29377

CRYSTAL STRUCTURE
The structure of amorphous hydrous erbium oxide gels
N78-29173
Direct observation of the point-defect structure of depleted-zones in ion-irradiated metals
N78-29213
A study of the vibrational spectra of the partially-deuterated polycrystalline ethylenes
N78-29951
Thin film gallium arsenide solar cells and crystal structure determination by X-ray diffraction
N78-29953

CRYSTAL SURFACES
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
Defect-free epitaxial layers for Si-vidicon targets
[NHK-LABS-NOTE-220] N78-29954

CRYSTALLIZATION
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947

CRYSTALLOGRAPHY
A methodology for the ergonomic design of interactive computer graphic systems, and its application to crystallography
N78-29767
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
Densities of states and spectral weight functions for disordered systems
N78-29939
Relaxation of third order elastic constants in crystals with point defects --- thermodynamics of nonlinear anelastic relaxation
N78-29943
Techniques of macromolecular crystallography
N78-29949

CUBIC LATTICES
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938

CURRENT DISTRIBUTION
The apparent resistance of aerials
[BLL-PO-TRANS-3538-[7737.47]]
N78-29341

CURRENT SHEETS
Interplanetary magnetic holes: Theory
[NASA-TM-79599] N78-30023

CURVE FITTING
Reduction and smoothing of multivariate time series with curve fitting methods
[NLR-MP-77014-U] N78-29853

CYCLIC HYDROCARBONS
Collisional stabilization of chemically activated molecules --- cyclic hydrocarbons
N78-29891

CYCLIC LOADS
The effects of microstructural features on the response of aluminum alloys to cyclic deformation
[AD-A053649] N78-29220
Fatigue testing of transversely loaded aluminium lugs, sequence 2
[FFA-TN-HU-1848] N78-29522
CYGNUS CONSTELLATION
Observations of three binary X-ray sources: CYG X-1, CYG X-2, and 4U1813+50 [AM HER]
N78-30016
CYLINDRICAL ANTENNAS
Transients in resistively loaded antennas and their comparison with conical antennas and TEM horns
[PB-279640/7] N78-29335
CYLINDRICAL BODIES
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503
A molecular dynamics study of a system of hard spherocylinders
N78-29890
Heat transfer studies from single cylinder and tube bundle in fluidized bed
N78-29964
CYLINDRICAL SHELLS
External loadings on nozzles in cylindrical shells
[CRIF-MT-122] N78-29520
CYLINDRICAL TANKS
Liquid propellant reorientation in a low-gravity environment
[NASA-TM-78969] N78-29407

D

D REGION
Laboratory measurements of selected D-region reactions
[AD-A054361] N78-29685
DAMAGE
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
DATA ACQUISITION
Aircraft hazard detection and control utilizing an aircraft data acquisition system
[AD-A054416] N78-29092
Search and differentiation algorithms and information theory applied to chemical spectroscopic and biochemical data
N78-29169
DATA BASES
Technical data requirements for shipboard and shorebased vertical/short takeoff and landing V/STOL aircraft
[AD-A054102] N78-29093
Microwave oscillators, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0333/1] N78-29384
Microwave oscillators. Citations from the engineering index data base
[NTIS/PS-78/0334/9] N78-29385
Phased arrays, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0331/5] N78-29386
Phased arrays. Citations from the engineering index data base
[NTIS/PS-78/0332/3] N78-29387
Gunn effect and transferred electron devices, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0361/2] N78-29388
Gunn effect devices, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0362/0] N78-29389
Storage reliability of missile materiel program, switch analysis
[AD-A053414] N78-29480
Infrared techniques for nondestructive testing. Citations from the NTIS data base
[NTIS/PS-78/0358/8] N78-29484
Infrared techniques for nondestructive testing. Citations from the engineering index data base
[NTIS/PS-78/0359/6] N78-29485
Object models for computer aided design
N78-29765
Optimization techniques in designing relational database systems
N78-29770
Transparent integrated intelligence network: Response normalization
[AD-A054308] N78-29773
An experiment in database access control
[AD-A054189] N78-29775
Management of Data Elements in Information Processing
[PB-279661/3] N78-29784
DATA CORRELATION
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Fitting and correlation
[NPL-CHEM-80] N78-29194
DATA LINKS
Communications Link Characterization Experiment [CLCE], volume 3
[NASA-CR-156801] N78-29306
DATA MANAGEMENT
Modeling and Analysis of Power Processing Systems [MAPPS], initial phase 2
[NASA-CR-135173] N78-29350
An experiment in database access control
[AD-A054189] N78-29775
Management of Data Elements in Information Processing
[PB-279661/3] N78-29784
HDM: Command and staff overview
[AD-A054482] N78-29803
DATA PROCESSING
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 2: Ground Processing requirements
[NASA-CR-145348-VOL-2] N78-29120
Spacelab Level 4 programmatic Implementation Assessment Study. Volume 3: Optimization and programmatics
[NASA-CR-145348-VOL-3] N78-29121
Communications Link Characterization Experiment [CLCE], volume 3
[NASA-CR-156801] N78-29306
Handling of fatigue data in computer analysis
N78-29498
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
N78-29766
Development of a laboratory data system executive summary
[PB-279765/2] N78-29782
Shifting the government's automatic data processing requirements to the private sector: Further study and better guidance needed
[PB-279482/4] N78-29783
DATA PROCESSING EQUIPMENT
The TIROS-N polar orbiting-environmental satellite system
[PB-280743/6] N78-29139
DATA PROCESSING TERMINALS
An assigned-slot listen-before-transmission protocol for a multiaccess data channel
N78-29296
HP/MME terminal: Application specification
[AD-A054722] N78-29774
DATA RECORDERS
PCM video recording using a rotating magnetic sheet
[NHK-LABS-NOTE-221] N78-29423
DATA RECORDING
Recording of measuring data on a cassette tape recorder using commercial FM components
[CSIR-TRANS-1401] N78-29425
DATA REDUCTION
Technique for dynamic range reduction for LANDSAT ratio images
[LA-UR-78-347] N78-29546
DATA SAMPLING
Synthesis of bandpass signals through the minimum number of samples
[R-5-77] N78-29330
DATA SMOOTHING
Reduction and smoothing of multivariate time series with curve fitting methods
[NLR-MP-77014-U] N78-29853
DATA STORAGE
Handling of fatigue data in computer analysis
N78-29498
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
N78-29766
Direct access data migration system
[PB-280074/6] N78-29780
Disk inventory system
[PB-280068/8] N78-29781
Efficient matrix transposition with limited high speed storage
[FOA-B-30021-E1] N78-29790
The visibility and impact of electronic storage and delivery of handbook-type information. Volume 1, part 1: Chapters 1-4. Part 2: Chapters 5 and appendices
[PB-278072/4] N78-29976
Solar terrestrial physics data exchange
[AD-A054101] N78-30030
DATA TRANSMISSION
An assigned-slot listen-before-transmission protocol for a multiaccess data channel
N78-29296
The use of redundant packets in slotted-Aloha-type radcom-access systems
[AD-A053737] N78-29318
DC 10 AIRCRAFT
Winglet and long duct nacelle aerodynamic development for DC-10 derivatives
N78-29049
DECISION MAKING
Concepts and techniques for evaluation of energy-related water problems
[PB-279608/4] N78-29619
The value of improved forecasts of climate for agricultural decision making
[PB-279452/7] N78-29713
Information service planning and evaluation: A goal programming approach
[AD-A054108] N78-29968
Strategies for conducting technology assessments
[PB-279471/7] N78-29973
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995
Adoption and utilization of urban technology: A decision-making study, analysis and conclusion, part 2
[PB-279541/7] N78-30010
DECISION THEORY
Decision rules and decision tree approach in pattern recognition theory
N78-29809
DECOMPOSITION
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197
DECOMPRESSION SICKNESS
Altitude decompression sickness: Review of concepts in primary care
[AD-A050849] N78-29737
DEEP SPACE NETWORK
Office of Space Tracking and Data Systems
[NASA-NEWS-RELEASE-78-129] N78-29115
DEFECTS
Semiconductor measurement technology: Automated photomask inspection --- used in fabrication of integrated circuits
[PB-279336/2] N78-29488
DEFORMATION
Effect of chordwise forces and deformations and deformations due to steady lift on wing flutter
[AD-A053640] N78-29110
The effects of microstructural features on the response of aluminum alloys to cyclic deformation
[AD-A053649] N78-29220
Nonlinear deformations and static buckling
[ESA-TT-478] N78-29524
DEHYDRATION
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197
DEICERS
Deicing-chemical rates on open-graded pavements: Studies in Maine, Michigan, Utah, and Vermont
[PB-279224/0] N78-29293
DELAMINATING
The applicability of infrared thermography in the detection of delamination in bridge decks
[PB-279508/6] N78-29285
DELAY CIRCUITS
The design of all-passes, low-passes and band-passes with a constant group delay approximated according to Chebishev
[CSIR-TRANS-1402] N78-29305
DEMAND [ECONOMICS]
Demand modelling of passenger air travel: An analysis and extension. Volume 1: Background and summary
[NASA-CR-157469] N78-29076
Peak load pricing of computer network services
N78-29806
DEMODULATORS
DEMOD/decoder integration
[AD-A053685] N78-29319
DENITROGENATION
Sources and characteristics of soluable organic nitrogen in activated-sludge effluents
N78-29991
DENSITY [NUMBER/VOLUME]
Simultaneous observations of the Na 5893A
[INPE-1081-PE/067] N78-29667
Densities of states and spectral weight functions for disordered systems
N78-29939
DENSITY MEASUREMENT
Beam deviation method as a diagnostic tool for the plasma focus
[IPF-78-3] N78-29931
DEPRESSANTS
The importance of the Myocardial Depressant Factor [MDF] for the occurrence of irreversible shock. A literature study
[MBL-1977-5] N78-29743
DESIGN ANALYSIS
Theory and design of conventional heat pipes for space applications
[NLR-TR-77001-U] N78-29420
Analytic method for dimensioning absolute stable control systems --- applied to air robots
[FOA-C-20187-E4] N78-29813
DESULFURIZING
Desulfurization of coal and petroleum, volume 2. A bibliography with abstracts
[NTIS/PS-78/0497/4] N78-29270

Hydrodesulfurization and liquefaction of a bituminous coal in a batch autoclave with particulate and monolith catalysts
N78-29564

DETERIORATION
Effect of steady flight loads on JT9D-7 performance deterioration
[NASA-CR-135407] N78-29105

DEVELOPING NATIONS
Facsimile communication and electronic mail system by satellite in Iran and other developing nations
N78-29301
Utilization of solar energy in developing countries: Identifying some potential markets
[NASA-TM-78964] N78-29578
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information --- organizations and information sources for technology utilization in developing countries
[PB-279193/7] N78-29981

DEVIATION
Beam deviation method as a diagnostic tool for the plasma focus
[IPF-78-3] N78-29931

DEW
The effect of wind and dew point on vegetative wetting duration
[PB-280041/5] N78-29708

DIAGNOSIS
Ultrasonics in medicine. Citations from the NTIS data base
[NTIS/PS-78/0494/1] N78-29879
Ultrasonics in medicine, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0495/8] N78-29880

DIAMONDS
Metastable diamond synthesis and the rate of carbon formation on diamond
N78-29237

DIATOMIC MOLECULES
Calculation of the laser induced Stark shifts in diatomic molecules
[AD-A053637] N78-29892

DIFFERENCE EQUATIONS
Adaptive minimum mean square error forecast of missile trajectory using stochastic difference equation models
[AD-A054540] N78-29846

DIFFERENTIAL AMPLIFIERS
A differential input gainranging amplifier employing monolithic integrated circuits
[FOA-C-20221-E4] N78-29383

DIFFERENTIAL EQUATIONS
Runge-Kutta formulas with extended regions of stability
N78-29818
A finite difference technique for solving optimization problems governed by linear functional differential equations
[AD-A053738] N78-29823
The implementation of implicit Runge-Kutta formulae for the solution of initial-value problems
[NPL-NAC-87] N78-29839
Stability properties of a nonlinear differential system in applied mathematics
[CTH-MATH-1977-15] N78-29865

DIFFERENTIAL GEOMETRY
Estimation and detection of Lie groups
[AD-A053633] N78-29821

DIFFRACTION PATTERNS
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955

DIFFUSION
Studies of solid-catalyzed systems subject to catalyst deactivation and diffusional limitations
N78-29176

DIFFUSION COEFFICIENT
Creep of oxide dispersion strengthened materials [with special reference to TD nichrome]
[NASA-CR-135432] N78-29217
Self diffusion in cells and tissues
[AD-A053422] N78-29727

DIFFUSION ELECTRODES
Experimental studies of interfacial electro chemistry
N78-29158

DIFFUSION THEORY
The application of diffusion approximations to the study of time-sharing computers and transitory queueing systems
[AD-A054313] N78-29812

DIFFUSION WELDING
Diffusion welding multifilament superconductive composites
[UCRL-80436] N78-29156

DIGITAL COMPUTERS
Implementation and error analysis in digital filters based on digital incremental computers
N78-29348
Advanced electronic technology
[AD-A054478] N78-29374
Analog and digital computer simulation of Coulomb friction
[PB-279465/9] N78-29467
General multi-configuration Hartree-Fock program: MCHF77
[COO-4264-1] N78-29805
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering --- problem solving methods at the University of Houston
[NASA-CR-157364] N78-29820

DIGITAL DATA
Digital simulation of flexible aircraft response to symmetrical and asymmetrical runway roughness
[AD-A053588] N78-29087
The GEOS-3 orbit determination investigation
[NASA-CR-141441] N78-29127
Implementation and error analysis in digital filters based on digital incremental computers
N78-29348
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] N78-29545

DIGITAL FILTERS
Tradeoff of hardware and signal-to-noise ratio in moving target indicators
[AD-A054727] N78-29322
Implementation and error analysis in digital filters based on digital incremental computers
N78-29348
The microprocessor INTEL 8080 A and its use as digital filter
[DLR-IB-552-77/22] N78-29779
A statistical package for computing time and frequency domain analysis
[NASA-TM-56045] N78-29843

DIGITAL SYSTEMS
Impairment of picture signals and subjective quality in digital coding: Edge business visibility
[BLL-PO-TRANS-3516-[7737.47]]
N78-29298
Digital communications/interoperability techniques
[AD-A053558] N78-29312
Considerations for a small economical earth terminal
[AD-A053623] N78-29313
Quantitative processing of signal space data to provide transmission line analysis
[AD-A053444] N78-29316
DEMOD/decoder integration
[AD-A053685] N78-29319
Image understanding research --- matching, radar imagery, and holograms
[AD-A054091] N78-29329
Procedures for functional partitioning and simulation of large digital systems
N78-29347
An examination of the weather graphics system [digital facsimile] acquisition
[AD-A053567] N78-29701
Interactive Digital Receiver Simulator [IDRS] system user's manual and software documentation
[AD-A053684] N78-29799

DIGITAL TECHNIQUES
Interactive computer methods for calculating geometrical and inertial properties of general shaped areas and volumes of revolution
N78-29764

DIMENSIONAL MEASUREMENT
Semiconductor measurement technology: Automated photomask inspection --- used in fabrication of integrated circuits
[PB-279336/2] N78-29488

DIMERS
Synthesis, magnetic susceptibility, and Moessbauer spectra of Fe[III] dimers and Fe[II] polymers containing 2,5-dihydroxy-1,4-benzoquinones
[AD-A054678] N78-29250

DIPOLE ANTENNAS
The apparent resistance of aerials
[BLL-PO-TRANS-3538-[7737.47]]
N78-29341
Dipole array on a transmission line
[AD-A054315] N78-29370

DIRECT CURRENT
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135341] N78-29992

DIRICHLET PROBLEM
Fast Poisson solvers on general two dimensional regions for the Dirichlet problem
[AD-A054539] N78-29830

DISCRETE FUNCTIONS
Discrete structural optimization
N78-29490
On a discrete Rodrigues' formula and a second class of orthogonal Hahn polynomials
[CTH-MATH-1977-12] N78-29864

DISPERSING
Fluid motion in packed bed reactors --- measuring the displacement of particles and flow velocity
N78-29406

DISPERSION
Creep of oxide dispersion strengthened materials [with special reference to TD nichrome]
[NASA-CR-135432] N78-29217

DISPLACEMENT
Simulation of saturated and unsaturated deformable porous media --- flow distribution and displacement in aquifiers
N78-29404

DISPLACEMENT MEASUREMENT
Fluid motion in packed bed reactors --- measuring the displacement of particles and flow velocity
N78-29406

DISPLAY DEVICES
The design of an optimum alphanumeric symbol set for cockpit displays
[AD-A053447] N78-29097
Radar-77
[AD-A053624] N78-29314
Integrated thin-film transistor display
[AD-A053627] N78-29358
Manufacturing methods and engineering for TFT addressed display
[AD-A054273] N78-29368
Development of a multimode liquid-crystal light value
[AD-A054728] N78-29956

DISTRIBUTING
Hierarchical organization of distributed packet-switching communication systems
N78-29295

DIURNAL VARIATIONS
The optimization of self-phased arrays for diurnal motion tracking of synchronous satellites
[NASA-CR-156795] N78-29134

DIVERTERS
Ripple bundle divertor for Tokamaks
[ORNL-TM-6220] N78-29926

DOMES [STRUCTURAL FORMS]
Possible new irdome materials for transmission to 4.5 - 5 micrometers
[AD-A053732] N78-29905

DOPED CRYSTALS
Energy transfer and dissipation processes in doped crystals
N78-29941

DOPPLER RADAR
Spring program '76. Section 1: Meteorological summary. Section 2: Doppler radar data quality control summary
[PB-280745/1] N78-29714

DRAG REDUCTION
Experimental results of winglets on first, second, and third generation jet transports --- to reduce drag coefficient
N78-29048
Experimental study of the flow of drag reducing fluids in a narrow isosceles triangular duct
N78-29400

DRAINAGE PATTERNS
Methodology for analyzing effects of urbanization on water resource systems
[PB-279663/9] N78-29557

DREDGED MATERIALS
Aquatic disposal field investigations, Eatons Neck disposal site, Long Island Sound. Appendix B: Water-quality parameters and physicochemical sediment parameters
[AD-A053427] N78-29630

DUCTED FLOW
Experimental study of the flow of drag reducing fluids in a narrow isosceles triangular duct
N78-29400

DURABILITY
Testing the stability of high-density polyethylene --- oxidation resistance, weathering, and durability
[BLL-PO-TRANS-3564-[7737.47]]
N78-29243

DUST
Regional air pollution study: Fugitive dust survey and inventory
[PB-279706/6] N78-29649

DYE LASERS
Pulsed laser-excited fluorescence
N78-29160
Development of pumps for pulse compression laser applications
[AD-A054223] N78-29440

DYNAMIC CHARACTERISTICS
Estimation and identification for modeling dynamic systems
[AD-A053583] N78-29826
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947

DYNAMIC MODELS
Dynamic model for computer control of the extrusion of solid dielectric cable
[EPRI-EL-605] N78-29381

DYNAMIC PRESSURE
Proposed design for a differential pressure gage to measure dynamic pressure in blast waves
[AD-A054372] N78-29427

DYNAMIC RESPONSE
Digital simulation of flexible aircraft response to symmetrical and asymmetrical runway roughness
[AD-A053588] N78-29087
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
Dynamics of high-speed linkages with elastic members
N78-29448
Dynamic response of a geometrically non-linear elastic/viscoelastic cylinder
N78-29491
Shock induced structural response
[AD-A053877] N78-29507
Computer module for one step dynamic response of an axisymmetric or plane linear elastic thin shell
[UCID-17730] N78-29512
DYNAMIC STABILITY
Singular perturbations, order reduction, and decoupling of large scale systems
[AD-A054483] N78-29829
DYNAMIC STRUCTURAL ANALYSIS
Heavy lift helicopter - advanced technology component program - rotor blade
[AD-A053423] N78-29089
Finite element analysis of air pulse wave loaded single thrown concrete plates
[FOA-C-20204-D4[A3]] N78-29516

E

EARTH ATMOSPHERE
Remote sensing of the earth's atmosphere by the use of radiation from ozone, oxygen and water vapor
N78-29530
Physical properties of design atmospheres
[ESDU-78008] N78-29660
EARTH MANTLE
Application of normal mode theory to seismic source and structure problems: Seismic investigations of upper mantle lateral heterogeneity
[NASA-CR-157354] N78-29673
EARTH MOVEMENTS
Application of a soil cap model to ground motion analyses
[AD-A053694] N78-29681
EARTH PLANETARY STRUCTURE
Lunar breccias, petrology, and earth planetary structure
[NASA-CR-157361] N78-30028
EARTH RESOURCES
Soyuz 22: New contribution to earth study from space
[NASA-TM-75055] N78-29535
Introduction to a multispectral data analysis system
[INPE-1227-NTE/115] N78-29541
The coverage behavior of ERDSAT for some selected regions of the world
[DLR-IB-552-78/1] N78-29548
Economic models, volume 3. A bibliography with abstracts
[NTIS/PS-78/0440/4] N78-29987
EARTH RESOURCES PROGRAM
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
The use of satellite imagery for lake classification in Wisconsin
[PB-279628/2] N78-29558
Crop forecasting by satellite: Progress and problems
[PB-279437/8] N78-29561
EARTHQUAKE RESISTANT STRUCTURES
Reinforced elastomers and friction supports: Modern methods of antiseismic support
[SAND-78-6001] N78-29257
EARTHQUAKES
A local earthquake coda magnitude and its relation to duration, moment M sub O, and local Richter magnitude M sub L
[NASA-CR-157473] N78-29664
Trends and Opportunities in Seismology
[PB-279320/6] N78-29694
ECOLOGY
Deep ocean mining and the ecology of the tropical north Pacific
[PB-279988/0] N78-29722
ECONOMETRICS
Demand modelling of passenger air travel: An analysis and extension. Volume I: Background and summary
[NASA-CR-157469] N78-29076
Updating the input-output matrix using mathematical methods
[INPE-1055-PE/062] N78-29792
The interdependence of nations: An agenda for research
[PB-279472/5] N78-29988
A review of energy models with particular reference to employment and manpower analysis
[PB-279447/7] N78-29989
ECONOMIC ANALYSIS
Study of capital requirements, cost estimates and economic analysis of a SRC-II [Solvent Refined Coal] plant under conditions related to the Federal Republic of Germany
[BMFT-FB-T-77-64] N78-29582
Overview of the economic theory of uncertainty and its implications for energy supply
[EPRI-EA-586] N78-29599
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
Economic models, volume 3. A bibliography with abstracts
[NTIS/PS-78/0440/4] N78-29987
The interdependence of nations: An agenda for research
[PB-279472/5] N78-29988
A review of energy models with particular reference to employment and manpower analysis
[PB-279447/7] N78-29989
Urban transportation economics: Proceedings of five workshops on pricing alternatives, economic regulations, labor issues, marketing, and government financing responsibilities
[PB-279689/4] N78-30009
ECONOMIC DEVELOPMENT
A methodology to regional planning
[INPE-1263-TPT/087] N78-29967
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information --- organizations and information sources for technology utilization in developing countries
[PB-279193/7] N78-29981
ECONOMIC IMPACT
Airport development: Social and economic effects. A bibliography with abstracts
[NTIS/PS-78/0447/9] N78-29114
ERDA net energy analysis program
[COO-2865-11] N78-29598
ECOSYSTEMS
Coastal upwelling ecosystems analysis. JOINT-II, the Thompson sections: R/V T. G. Thompson cruise 108
[PB-279173/9] N78-29718
Coastal upwelling ecosystems analysis. Vertical sections of temperature, salinity and sigma-T. JOINT-II-R/V Thomas G. Thompson Cruise 108 Leg I
[PB-279174/7] N78-29719
EDDINGTON APPROXIMATION
Photohydrodynamic stability near the Eddington limit
N78-30014
EDGES
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902
EDUCATION
Integrated circuits for managers
[SAND-77-0553C] N78-29378
EFFLUENTS
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Sources and characteristics of soluable organic nitrogen in activated-sludge effluents
N78-29991
EIGENVALUES
Some optimal properties and interpretations of principal components
[AD-A054555] N78-29834
EIGENVECTORS
An integral representation for eigenfunctions of linear ordinary differential operators
[AD-A054543] N78-29832
ELASTIC CYLINDERS
Dynamic response of a geometrically non-linear elastic/viscoelastic cylinder
N78-29491
ELASTIC DEFORMATION
Elastic-plastic crack closure analysis of Dugdale crack plates based on fatigue fracture mechanics
[REPT-30] N78-29489
Rate theory of a two-dimensional elasto-plastic continuum
[TAE-303] N78-29502
Structural design for a 10-GWh SMES vacuum vessel
[LA-7110-MS] N78-29514
The deformation of steel bars in a four-point bending machine, measured by holographic interferometry
[NPL-MOM-27] N78-29517
ELASTIC PROPERTIES
Oxygen and nitrogen diffusion in group V transition metals
N78-29205
Dynamics of high-speed linkages with elastic members
N78-29448
Some investigations relating to the elastostatics of a tapered tube
[AD-A054330] N78-29508
The edge-function method [E.F.M.]
[AD-A054265] N78-29827
On the influence of a flexural biasing state on the velocity of piezoelectric surface waves
[AD-A054397] N78-29957
ELASTIC SCATTERING
The valence-core exchange model
N78-29945
ELASTIC SHELLS
Computer module for one step dynamic response of an axisymmetric or plane linear elastic thin shell
[UCID-17730] N78-29512
ELASTOHYDRODYNAMICS
The role of temperature in EHD
[AD-A054320] N78-29454
ELASTOMERS
Reinforced elastomers and friction supports: Modern methods of antiseismic support
[SAND-78-6001] N78-29257
ELASTOPLASTICITY
Hydraulic pressure pulses with elastic and plastic structural flexibility: Test and analysis [LWBR development program]
[WAPD-TM-1375] N78-29515
ELASTOSTATICS
Some investigations relating to the elastostatics of a tapered tube
[AD-A054330] N78-29508
ELECTRIC BATTERIES
Storage reliability of missile materiel program, missile systems battery analysis
[AD-A053410] N78-29481
Development of an iron-air battery system for electric vehicles
[TID-27914] N78-29604
ELECTRIC CONDUCTORS
Measurement of the coupling impedance and crosstalk between coaxial conductors
[RAE-LIB-TRANS-1961] N78-29354
ELECTRIC CURRENT
Current-driven turbulence in plasmas
[REPT-77-106] N78-29929
Current and neutron yield scaling of fast high voltage plasma focus
[IPF-77-2] N78-29930
ELECTRIC ENERGY STORAGE
Inductive power coupling for an electric highway system --- supplying power to electric motor vehicles
[LBL-7262] N78-29998
ELECTRIC EQUIPMENT
On the width of the commutation zone of direct current electrical machines with smooth-core armatures
[BLL-RTS-10633] N78-29338
ELECTRIC FIELDS
Ionospheric electrical fields
[INPE-1144-PE/098] N78-29676
ELECTRIC GENERATORS
Power system simulator
[AD-A054476] N78-29375
Planning in interconnected power systems: An example of two-stage programming under uncertainty
[AD-A054554] N78-29376
Assessment of fuel processing alternatives for fuel cell power generation
[EPRI-EM-570] N78-29596
Diagnostics assessment for advanced power systems
[SAND-78-8206] N78-29603
GAC-ANL TNS scoping studies. Volume II: TNS doublet Tokamak ohmic-heating power supply study --- Tokamak reactor technology
[GA-A-14614-VOL-II] N78-29919
ELECTRIC MOTOR VEHICLES
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135340] N78-29584
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135341] N78-29992
Inductive power coupling for an electric highway system --- supplying power to electric motor vehicles
[LBL-7262] N78-29998
ELECTRIC MOTORS
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135341] N78-29992
ELECTRIC POTENTIAL
Current and neutron yield scaling of fast high voltage plasma focus
[IPF-77-2] N78-29930
ELECTRIC POWER PLANTS
Ocean thermal and current velocity data requirements for design of an OTEC Demonstration plant
[PB-280728/7] N78-29622
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 2: Technical discussion
[PB-279636/5] N78-29639

St. Louis demonstration: Power plant equipment, facilities and environmental evaluations
[PB-279828/8] N78-29655
ELECTRIC POWER SUPPLIES
Inductive power coupling for an electric highway system --- supplying power to electric motor vehicles
[LBL-7262] N78-29998
ELECTRIC RELAYS
Storage reliability of missile materiel program, relay analysis
[AD-A053413] N78-29478
ELECTRIC SWITCHES
On calculation of alternating current switching processes and pulse distortion in narrow band systems
[BLL-RTS-10557] N78-29337
ELECTRIC TERMINALS
Wisconsin test facility ground terminal corrosion study --- inspection of underground electric cables
[AD-A053715] N78-29363
ELECTRIC WIRE
Note on the cryostatic stability of superconducting composites --- long wire concept
[ORNL-TM-5989] N78-29962
ELECTRICAL ENGINEERING
Electrophoretic separator for purifying biologicals, part I
[NASA-CR-150768] N78-29183
Electronics engineering research proposals for FY78
[UCID-17711] N78-29379
ELECTRICAL FAULTS
Evaluation of the cumulative failure rate of a system: The optimal interval for preventive replacement of traveling wave tubes
[NHK-LABS-NOTE-222] N78-29342
The anomalous voltage response of the P[+]N[-]N[+] device and its effects on second breakdown
[AD-A053539] N78-29359
ELECTRICAL IMPEDANCE
Measurement of the coupling impedance and cross-talk between coaxial conductors
[RAE-LIB-TRANS-1961] N78-29354
ELECTRICAL PROPERTIES
Some investigations in theoretical and experimental electrochemistry
N78-29170
Electrical properties and structure of BaO-B2O3-SiO2 glass containing titanium ions
N78-29204
Electrical properties of Pb0.8Sn0.2Te spitaxial films
[AD-A053456] N78-29361
A theoretical analysis of the current-voltage characteristics of solar cells
[NASA-CR-157369] N78-29585
The Second International Conference on the Electronic Properties of 2-Dimensional Systems
[AD-A054419] N78-29960
ELECTRICAL RESISTANCE
The effects of substrate composition on thick film circuit reliability
[AD-A054316] N78-29958
ELECTRO-OPTICS
Storage reliability of missile materiel program. Storage reliability summary report. Volume 5: Optical and electro-optical devices
[AD-A053407] N78-29473
Electrooptical devices
[AD-A054477] N78-29907
ELECTROCHEMICAL OXIDATION
Experimental studies of interfacial electro chemistry
N78-29158
ELECTROCHEMISTRY
Some investigations in theoretical and experimental electrochemistry
N78-29170
ELECTROJETS
Nonlinear analysis of plasma instability excited by the auroral electrojet
[AD-A053647] N78-29678
ELECTROLUMINESCENCE
Integrated thin-film transistor display
[AD-A053627] N78-29358
ELECTROLYTES
Adhesion of electrolytic zinc to aluminum cathodes
[BLL-RTS-10973] N78-29209
ELECTROMAGNETIC ABSORPTION
Microwave absorption studies near the plasma frequency
[LA-UR-78-51] N78-29928
ELECTROMAGNETIC COMPATIBILITY
Computer aided EMC analysis - a review of available tools
[NLR-TR-77070-U] N78-29331
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 4: Prediction of crosstalk in ribbon cables
[AD-A053548] N78-29355
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 5: Prediction of crosstalk involving twisted wire pairs
[AD-A053559] N78-29356
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 6: A digital computer program for determining thermal currents induced in a multiconductor transmission line by an incident electromagnetic field
[AD-A053560] N78-29357
ELECTROMAGNETIC WAVE TRANSMISSION
The RIAR system, a new telecommunication system. High-altitude, artificially-ionised regions. Possible extension to VHF, UHF and SHF telecommunication
[RAE-LIB-TRANS-1968] N78-29311
ELECTROMECHANICAL DEVICES
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132
ELECTRON ATTACHMENT
Calculation of electron binding energies --- ionization energies for water and neon and electron affinity of lithium hydride
N78-29882
ELECTRON BEAMS
Electron-beam fusion welding of beryllium
[RFP-2621] N78-29459
A new collective particle accelerator --- using density modulated, intense, relativistic electron beam in spatially modulated, magnetic field
[AD-A053759] N78-29893
ELECTRON ENERGY
Selection rule effects in electronic excitations of chemisorbed molecules as studied by energy loss spectroscopy
[AD-A054105] N78-29894
The dissipative trapped electron instability in the linear multi-mirror device
N78-29909
ELECTRON IRRADIATION
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001
ELECTRON MICROSCOPY
Dispersive and nondispersive analysis: Comparison of the two techniques used in microanalysis by means of an electron microprobe
[BLL-PO-TRANS-3531-[7737.47]]
N78-29422
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955
ELECTRON PARAMAGNETIC RESONANCE
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals --- l-alanine, triglycine sulfate, and 3-hydroxyanthine
N78-29935
ELECTRON SCATTERING
Selected topics from the theory of electron-atom and atom-atom collisions
N78-29885
ELECTRON TRANSFER
Gunn effect and transferred electron devices, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0361/2] N78-29388
ELECTRONIC COUNTERMEASURES
Electronic countermeasures and electronic counter countermeasures, volume 1. A bibliography with abstracts
[NTIS/PS-78/0336/4] N78-29332
Electronic countermeasures and electronic counter countermeasures, volume 2: A bibliography with abstracts
[NTIS/PS-78/0337/2] N78-29333
ELECTRONIC EQUIPMENT
A new method of detecting defects in electronic devices --- by determining the jitter behavior
[BLL-PO-TRANS-3553-[7737.47]]
N78-29340
Electronic equipment screening and debugging techniques
[AD-A053561] N78-29365
Accelerated reliability tests on electronic components and equipment
[BLL-PO-TRANS-3557-[7737.47]]
N78-29469
Storage reliability of missile materiel program. Storage reliability analysis summary report. Volume 1: Electrical and electronic devices
[AD-A053405] N78-29470
Electrooptical devices
[AD-A054477] N78-29907
ELECTRONIC EQUIPMENT TESTS
Accelerated reliability tests on electronic components and equipment
[BLL-PO-TRANS-3557-[7737.47]]
N78-29469
ELECTRONICS
Advanced electronic technology
[AD-A054478] N78-29374
ELECTROPHORESIS
Irreversible thermodynamic analysis of electrophoretic light scattering experiments
N78-29161
SPAR project: Counter current distribution of biologicals
[NASA-CR-150766] N78-29182
Electrophoretic separator for purifying biologicals, part I
[NASA-CR-150768] N78-29183
ELECTROSLAG REFINING
Comparison of the microstructure and mechanical properties of 300-M steel manufactured by the vacuum arc remelt and the electroslag remelt processes
[LBL-6686] N78-29226
EMISSION SPECTRA
TEA laser emission on the sequence bands of CO2
[AD-A054149] N78-29437
EMPLOYMENT
A review of energy models with particular reference to employment and manpower analysis
[PB-279447/7] N78-29989
EMULSIONS
A mechanism for ultralow interfacial tension in systems containing microemulsions: Theoretical considerations and experiments with ultracentrifuge
N78-29175
Nuclear resonance in dispersed systems --- oil/water ratios in liquid crystals and microemulsions
N78-29950
ENERGETIC PARTICLES
Energetic particles and ionization in the nighttime middle and low latitude ionosphere
[NASA-CR-156943] N78-29665
ENERGY
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
ENERGY CONSERVATION
Short-haul CTOL aircraft research --- on reduced energy for commercial air transportation
N78-29061
ERDA net energy analysis program
[COO-2865-11] N78-29598
Energy conservation through building design. Citations from the NTIS data base
[NTIS/PS-78/0444/6] N78-29615
Energy conservation through building design. Citations from the engineering index data base
[NTIS/PS-78/0445/3] N78-29616
Energy conservation: Buildings, volume 1. A bibliography with abstracts
[NTIS/PS-78/0502/1] N78-29617
Energy conservation: Buildings, volume 2. A bibliography with abstracts
[NTIS/PS-78/0503/9] N78-29618
Energy conservation policy evaluation. Study module 1A, volume 2: Technical appendix
[PB-279664/7] N78-29620
ENERGY CONSUMPTION
Program PRESTO: Preparation of reference energy systems through time
[BNL-50723] N78-29594
Overview of the economic theory of uncertainty and its implications for energy supply
[EPRI-EA-586] N78-29599
Incorporating uncertainty in energy supply models
[EPRI-EA-703-VOL-2] N78-29602
Energy conservation: Buildings, volume 1. A bibliography with abstracts
[NTIS/PS-78/0502/1] N78-29617
Energy conservation: Buildings, volume 2. A bibliography with abstracts
[NTIS/PS-78/0503/9] N78-29618
Energy conservation policy evaluation. Study module 1A, volume 2: Technical appendix
[PB-279664/7] N78-29620
Integrating policy analysis
[PB-279217/4] N78-29621
NOAA climate program --- climate effects on agriculture, energy consumption and fishery production
[PB-281195/8] N78-29712
ENERGY CONVERSION EFFICIENCY
ERDA net energy analysis program
[COO-2865-11] N78-29598
ENERGY DISSIPATION
Review of magnetospheric boundary layer phenomena and relations to current theories
[TRITA-EPP-77-25] N78-29691
Energy transfer and dissipation processes in doped crystals
N78-29941
ENERGY LEVELS
Calculation of electron binding energies --- ionization energies for water and neon and electron affinity of lithium hydride
N78-29882
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889
ENERGY POLICY
Solar power satellite system definition study. Part 3: Preferred concept system definition
[NASA-CR-151746] N78-29133
Development, testing, and certification of life sciences engineering solar collector
[NASA-TM-78182] N78-29573

Large wind turbine generators
[NASA-TM-73767] N78-29575
Thermal energy storage for industrial waste heat recovery
[NASA-TM-78953] N78-29576
Storage systems for solar thermal power
[NASA-TM-78952] N78-29577
The 200-kilowatt wind turbine project
[NASA-TM-79757] N78-29583
ERDA net energy analysis program
[COO-2865-11] N78-29598
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
Energy conservation policy evaluation. Study module 1A, volume 2: Technical appendix
[PB-279664/7] N78-29620
Integrating policy analysis
[PB-279217/4] N78-29621

ENERGY SOURCES
Coal as an energy resource, conflict and consensus
[PB-279539/1] N78-29623

ENERGY SPECTRA
Energy spectrum of medium energy gamma-rays from the galactic center region --- experimental design
[NASA-TM-78331] N78-30035

ENERGY STORAGE
Measurement techniques for the characterization in the frequency domain of regulated energy-storage DC-to-DC converters
[NASA-CR-157474] N78-29349
Structural design for a 10-GWh SMES vacuum vessel
[LA-7110-MS] N78-29514
Installation package for 77-180 SOLARSTAT and 77-1 controller
[NASA-CR-150743] N78-29571
Storage systems for solar thermal power
[NASA-TM-78952] N78-29577
Thermal energy storage demonstration unit for Vuilleumier cryogenic cooler
[AD-A054466] N78-29589

ENERGY TECHNOLOGY
Utilization of solar energy in developing countries: Identifying some potential markets
[NASA-TM-78964] N78-29578
Satellite Power System [SPS] concept development and evaluation program plan, July 1977 - August 1980
[NASA-TM-79400] N78-29593
Western gas sands project
[NVO/0655-100] N78-29597
Diagnostics assessment for advanced power systems
[SAND-78-8206] N78-29603
Concepts and techniques for evaluation of energy-related water problems
[PB-279608/4] N78-29619
A review of energy models with particular reference to employment and manpower analysis
[PB-279447/7] N78-29989

ENERGY TRANSFER
Laser induced vibrational energy transfer and chemical reactions
N78-29431
Calculation of the laser induced Stark shifts in diatomic molecules
[AD-A053637] N78-29892
Energy transfer and dissipation processes in doped crystals
N78-29941

ENGINE DESIGN
Mixing and combustion in high speed air flows --- combustor design
[AD-A054398] N78-29188

ENGINE FAILURE
Overview of safety research
N78-29054

ENGINE NOISE
Noise suppression in jet inlets
[AD-A054173] N78-29107
Community noise exposure resulting from aircraft operations. Volume 1: Acoustic data on military aircraft
[AD-A053699] N78-29872
On estimating the sound radiation of large radial ventilators from acoustic measurements at a model test stand
[DLR-IB-257-77/2] N78-29878

ENGINE PARTS
Long-term CF6 engine performance deterioration: Evaluation of engine S/N 451-380
[NASA-CR-159390] N78-29103
Tapered roller bearing development for aircraft turbine engines
[AD-A054045] N78-29458

ENGINE TESTS
Long-term CF6 engine performance deterioration: Evaluation of engine S/N 451-380
[NASA-CR-159390] N78-29103
Turbine engine rotor dynamic evaluation. Volume 2: Engine and test rig balancing
[AD-A054533] N78-29108
Quick look test report: MPT static firing no. 2 test MPT-S2
[NASA-CR-151814] N78-29141

ENGINEERING DRAWINGS
Processes of plastic deformation, their conditions and effect on the properties of the final product
[LA-TR-77-68] N78-29279

ENVIRONMENT EFFECTS
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0423/0] N78-29551
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0424/8] N78-29552
Estimating environmental damages from surface mining of coal in Appalachia: A case study
[PB-279150/7] N78-29553
Survey of models to predict the effect of geothermal power development on domestic water supplies and to design pollution monitoring methods
[UCRL-79977] N78-29637
Study of effects of space power satellites on life support functions of the earth's magnetosphere
[NASA-CR-156948] N78-29674

ENVIRONMENT MANAGEMENT
Environment, technology, and future generations
[PB-279605/0] N78-29645

ENVIRONMENT POLLUTION
Medical and biologic effects of environmental pollutants platinum-group metals
[PB-279464/2] N78-29659
Scientific and technical publication of the Environmental Research Laboratories: Fiscal year 1976 [1 July 1975 through 30 September 1976]
[PB-280786/5] N78-29983

ENVIRONMENT PROTECTION
Analytical studies for the US Environmental Protection Agency. Volume 4: Environmental monitoring
[PB-279534/2] N78-29640
Analytical studies for the US Environmental Protection Agency. Volume 8. Noise abatement: Policy alternatives for transportation
[PB-279536/7] N78-29641
Research and development in the Environmental Protection Agency, volume 3
[PB-279370/1] N78-29653
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978
[PB-279607/6] N78-29971

ENVIRONMENT SIMULATION
A design for machine learning during continuous interaction with a simulated environment
N78-29771

ENVIRONMENTAL LABORATORIES
Economic models, volume 3. A bibliography with abstracts
[NTIS/PS-78/0440/4] N78-29987

ENVIRONMENTAL MONITORING
Analytical studies for the US Environmental Protection Agency. Volume 4: Environmental monitoring
[PB-279534/2] N78-29640

ENVIRONMENTAL SURVEYS
Low- and medium-Btu gasification systems: Technology overview
[PB-279641/5] N78-29275
Model environmental impact statement no. 1, Bicentennial International Airport, Northeast, America
[AD-A049171] N78-29628
Model environmental impact statement no. 2 for Freedom Airport, Southeast, America
[AD-A049300] N78-29629
Studies of air pollution effects on vegetation
[UCID-17714] N78-29634

EPITAXY
Defect-free epitaxial layers for Si-vidicon targets
[NHK-LABS-NOTE-220] N78-29954

EPOXY COMPOUNDS
Kevlar 49-epoxy insulator
[SAND-77-0500] N78-29256
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503

EPOXY RESINS
Coupling agents: HME resin system
[AD-A054394] N78-29153

EQUATIONS OF MOTION
Use of operator equation of motion techniques in treating collective excitations
N78-29942
Analytic theory of orbit contraction
[NASA-CR-157359] N78-30022

EQUATIONS OF STATE
Recent development in the Sesame equation-of-state library
[LA-7130] N78-29804
Densities of states and spectral weight functions for disordered systems
N78-29939

EQUATORS
Variability of water temperature in the Atlantic near the equator --- GARP Atlantic Tropical Experiment
[BLLD-M-24959-[5828.4F]] N78-29717

EQUILIBRIUM EQUATIONS
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914

EQUIVALENCE
Linear equivalences in hereditary control systems
N78-29808

ERBIUM COMPOUNDS
The structure of amorphous hydrous erbium oxide gels
N78-29173

ERROR ANALYSIS
Implementation and error analysis in digital filters based on digital incremental computers
N78-29348
The accuracy of aspiration thermometers
[KNMI-WR-78-1] N78-29430
Analysis of evolutionary error in finite element and other methods
[AD-A054551] N78-29828
A posteriori error bounds for two-point value problems
[AD-A054544] N78-29831
An inverse regression method for determining an ensemble of state error vectors from a covariance matrix
[AD-A054214] N78-29845
Adaptive minimum mean square error forecast of missile trajectory using stochastic difference equation models
[AD-A054540] N78-29846

ERROR DETECTION CODES
Modifications to the accuracy assessment analysis routine SPATL to produce an output file
[NASA-CR-151810] N78-29791

ESCAPE SYSTEMS
Powered inertia reel retraction during ejection
[AD-A054157] N78-29077

ESTIMATING
A method for the estimation of the critical temperatures of alkanols
[NPL-CHEM-81] N78-29195
On estimating the sound radiation of large radial ventilators from acoustic measurements at a model test stand
[DLR-IB-257-77/2] N78-29878

ETHERS
A preliminary investigation of the interaction of M-50 steel with a perfluoalkylether fluid and a 1 percent additive-fluid formulation
[AD-A054044] N78-29253

ETHYLENE
A study of the vibrational spectra of the partially-deuterated polycrystalline ethylenes
N78-29951

EUCLIDEAN GEOMETRY
Codimension one isometric immersions between Lorentz spaces
N78-29858

EULER-LAGRANGE EQUATION
Notes on the unsteady rectilinear motion of a perfect gas. Part 3: Homogeneous solutions of the Lagrangian equations of motion
[VTH-LR-258] N78-29419

EUROPEAN SPACE PROGRAMS
The coverage behavior of ERDSAT for some selected regions of the world
[DLR-IB-552-78/1] N78-29548

EUROPIUM
Experimental studies of interfacial electro chemistry
N78-29158

EUTROPHICATION
National water quality inventory 1976 report to Congress
[PB-279462/6] N78-29647

EVAPORATION
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947
Heat transfer correlations for the nucleate, convective and dispersed regions of horizontal in-tube evaporation
N78-29965

EVOKED RESPONSE [PSYCHOPHYSIOLOGY]
The frequency following response in humans
N78-29734

EVOLUTION [DEVELOPMENT]
On scattering diagnostics with periodically pulsed lasers to follow the continuous evolution of time dependent plasma parameters
[IPF-77-5] N78-29445

EXCITATION
Lifetimes of excited states of barium and lanthanum and the modification of the Hanle effect by strong optical pumping
N78-29884

EXHAUST GASES
Effect of air temperature and relative humidity at various fuel-air ratios on exhaust emissions on a per-mode basis of an AVCO Lycoming 0-320 diad light aircraft engine: Volume 1: Results and plotted data
[NASA-TM-73507-VOL-1] N78-29100

Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 2: Technical discussion
[PB-279636/5] N78-29639
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657

EXPERIMENTAL DESIGN
A design for machine learning during continuous interaction with a simulated environment
N78-29771
A study of correlation among error terms of a repeated measures design
N78-29815
Critical field experiments on uses of scientific and technical information
[PB-279693/6] N78-29980
Energy spectrum of medium energy gamma-rays from the galactic center region --- experimental design
[NASA-TM-78331] N78-30035

EXPLOSIVE DECOMPRESSION
Medical evaluation of 2-pressure suit used in explosive decompressions up to 20.000 m altitude
[FOA-A-59002-H3] N78-29761

EXTERNAL STORES
Investigation of the unsteady airloads on wing-store configurations in subsonic flow
[NLR-MP-77025-U] N78-29073

EXTRAPOLATION
The microprocessor INTEL 8080 A and its use as digital filter
[DLR-IB-552-77/22] N78-29779

EXTRATERRESTRIAL INTELLIGENCE
A critical review of the state of foreign space technology
[NASA-CR-157363] N78-29118

EXTRAVEHICULAR MOBILITY UNITS
Extravehicular activity translation arm [EVATA] study
[NASA-CR-151755] N78-29145

EXTRUDING
Dynamic model for computer control of the extrusion of solid dielectric cable
[EPRI-EL-605] N78-29381

F

F-14 AIRCRAFT
Turbine engine rotor dynamic evaluation. Volume 2: Engine and test rig balancing
[AD-A054533] N78-29108

FABRICATION
Methods of fabricating ceramic materials
[AD-A054043] N78-29252
Light emitting diodes for fiber optic communications --- fabrication
[AD-A053657] N78-29903
Fabrication of light guides for astrophysics experiments
[NASA-TM-78099] N78-30036

FACSIMILE COMMUNICATION
An examination of the weather graphics system [digital facsimile] acquisition
[AD-A053567] N78-29701

FACTOR ANALYSIS
Computation of the irregularity-factor N sub o/N sub 1 of a stationary Gaussian process with dual peak power spectral density
[TB-137] N78-29501
A factor model of urban aerosol pollution: A new method of source identification
N78-29625
A study of correlation among error terms of a repeated measures design
N78-29815

FAILURE ANALYSIS
Evaluation of the cumulative failure rate of a system: The optimal interval for preventive replacement of traveling wave tubes
[NHK-LABS-NOTE-222] N78-29342
MSFC assessment of Owens-Illinois SUNPAK collector problems
[NASA-TM-78179] N78-29572

FARM CROPS
Measurement of soil moisture trends with airborne scatterometers
[E78-10176] N78-29532
Evaluation of wavelength groups for discrimination of agricultural cover types --- remote sensing of environment in INDIANA
[NASA-CR-157393] N78-29536

FARMLANDS
Analysis of the dynamics of shifting cultivation in the tropical forests of Northern Thailand using LANDSAT modeling and classification of LANDSAT imagery
[E78-10178] N78-29534

FAST NEUTRONS
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889

FASTENERS
Development of corrosion resistant fastening systems for aircraft carrier steam catapults
[AD-A053656] N78-29112

FATIGUE [MATERIALS]
A stochastic model for fatigue and optimum design and maintenance methodologies
N78-29081
Low cycle-fatigue and fracture behaviour as parameters for the dimensioning of high pressure vessels
[ICAF-1012] N78-29499

FATIGUE LIFE
Predicted effects of residual stresses on butt weld fatigue life
N78-29494

FATIGUE TESTS
Corrosion fatigue of high strength aircraft structural materials - crystallographic dependence of fracture path in Al-Zn-Mg [7075] alloys
[AD-A053743] N78-29221
Fatigue tests on I-beams of steel St 52-3
[FB-91] N78-29497
Handling of fatigue data in computer analysis
N78-29498
Fatigue strength of a fibre-reinforced material
N78-29500
The method of maximum likelihood applied to the statistical analysis of fatigue data including run-outs
[ICAF-1036] N78-29504
Fatigue testing of transversely loaded aluminium lugs, sequence 2
[FFA-TN-HU-1848] N78-29522

FEED SYSTEMS
Design and testing of a small feedwater pump
[AD-A053646] N78-29453

FEEDBACK CONTROL
Analytic method for dimensioning absolute stable control systems --- applied to air robots
[FOA-C-20187-E4] N78-29813

FIBER OPTICS
Fiber optics and microprocessors: A control-system solution for the laser-fusion environment
[LA-UR-78-329] N78-29777
Light emitting diodes for fiber optic communications --- fabrication
[AD-A053657] N78-29903

FIBERS
Computer assisted characterization of a filament electrothermal atomizer
N78-29168

FIELD THEORY [PHYSICS]
Critical behavior of Reggeon field theory on a lattice --- using Hamiltonian formalism
N78-29944

FIGHTER AIRCRAFT
Calculation of pressure distribution, forces and moments for the fighter configuration IAe 60 by panel method
[DLR-IB-151-77/13] N78-29072
Community noise exposure resulting from aircraft operations. Volume 4: Acoustic data on Air Force trainer/fighter aircraft
[AD-A053702] N78-29873

FILE MAINTENANCE [COMPUTERS]
Studies on clustered files
N78-29772
Modifications to the accuracy assessment analysis routine MLTCRP to produce an output file
[NASA-CR-151811] N78-29794
Recent development in the Sesame equation-of-state library
[LA-7130] N78-29804

FINITE DIFFERENCE THEORY
A finite difference technique for solving optimization problems governed by linear functional differential equations
[AD-A053738] N78-29823

FINITE ELEMENT METHOD
Numerical solutions of the unsteady transonic small-disturbance equations
[AD-A054036] N78-29071
Simulation of saturated and unsaturated deformable porous media --- flow distribution and displacement in aquifiers
N78-29404
Finite element analysis of rotor-bearing systems with matrix reduction
N78-29492
Finite elements for the elastic analysis of composite beams and bridges
N78-29496
The NASTRAN programmer's manual [level 16.0]
[NASA-SP-223[03]] N78-29505
The NASTRAN user's manual: Level 16.0 supplement
[NASA-SP-222[03]] N78-29506
Shock induced structural response
[AD-A053877] N78-29507
Finite element analysis of air pulse wave loaded single thrown concrete plates
[FOA-C-20204-D4[A3]] N78-29516
Numerical simulation of ionospheric and plasmaspheric dynamics
[AD-A053451] N78-29680
The finite element method applied to a class of time-dependent nonlinear partial differential equations
[TN-21] N78-29819
Analysis of evolutionary error in finite element and other methods
[AD-A054551] N78-29828

FIRES
Overview of safety research
N78-29054

FISHERIES
NOAA climate program --- climate effects on agriculture, energy consumption and fishery production
[PB-281195/8] N78-29712

FIXED POINTS [MATHEMATICS]
Decomposition in fixed point computation --- operations research and optimization
[AD-A053439] N78-29797

FIXED WINGS
Aircraft military utility and functional tests
[AD-A053617] N78-29091

FLAME PROPAGATION
The effect of sample orientation on flame spread across polyurethane foams
N78-29181
Mathematical theory of laminar combustion. 3: Perturbations
[AD-A054538] N78-29189
Mathematical theory of laminar combustion. 2: The premixed plane flame
[AD-A054537] N78-29190

FLAME SPECTROSCOPY
A spectroscopic investigation of the hydrogennitric oxide flame
N78-29178

FLAME STABILITY
Flame efficiency, stabilization and performance in prevaporizing/premixing combustors
[AD-A053635] N78-29184

FLAMES
Investigating mapping techniques for elucidating processes occurring in pyrotechnic flames and their flame analogs
[AD-A053373] N78-29260

FLASH LAMPS
Development of pumps for pulse compression laser applications
[AD-A054223] N78-29440

FLAT PLATES
Development, testing, and certification of life sciences engineering solar collector
[NASA-TM-78182] N78-29573
Analysis of Chamberlin flat plate solar collector using National Bureau of Standards test criteria
[AD-A054215] N78-29588

FLEXIBILITY
Hydraulic pressure pulses with elastic and plastic structural flexibility: Test and analysis [LWBR development program]
[WAPD-TM-1375] N78-29515

FLICKER
The apparent rate of flicker
[NHK-LABS-NOTE-219] N78-29748

FLIGHT CONTROL
Propulsion/flight control integration technology [PROFIT] design analysis status
[NASA-CR-144875] N78-29101
Propulsion/flight control integration technology [PROFIT] software system definition
[NASA-CR-144876] N78-29102

FLIGHT HAZARDS
Simulation and analysis of wind shear hazard --- for aircraft landing and takeoff
[NASA-CR-157470] N78-29699

FLIGHT INSTRUMENTS
The design of an optimum alphanumeric symbol set for cockpit displays
[AD-A053447] N78-29097

FLIGHT OPERATIONS
Man-machine interface analysis of the flight design system
[NASA-CR-151812] N78-29754

FLIGHT PLANS
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078

FLIGHT RECORDERS
Assessment of service load experience using AIDS-recorded data
[NLR-MP-77011-U] N78-29096
Preliminary design of an accident Information Retrieval System [AIRS] --- using microprocessors for data storage in military helicopters
[HSER-7342] N78-29974

FLIGHT SIMULATION
Concepts and requirements for shuttle/payload orbital operations of the space transportation system
[NASA-CR-151808] N78-29143

FLIGHT TESTS
Flight experiments to improve terminal area operations
N78-29058
Heavy lift helicopter - advanced technology component program - rotor blade
[AD-A053423] N78-29089
Aircraft military utility and functional tests
[AD-A053617] N78-29091
Electrophoretic separator for purifying biologicals, part 1
[NASA-CR-150768] N78-29183
Recording of measuring data on a cassette tape recorder using commercial FM components
[CSIR-TRANS-1401] N78-29425
Comparison between flight test data and data from a theoretical model for the discovery of a ground target from the air
[FOA-C-56010-H9/H6] N78-29751
FLIGHT TRAINING
Verbal prescriptive rules in cognitive pretraining for the vertical S-A training maneuver
[AD-A050971] N78-29749
Measuring pilot proficiency on an instrument training maneuver
[AD-A050972] N78-29755
FLOOD CONTROL
Methodology for analyzing effects of urbanization on water resource systems
[PB-279663/9] N78-29557
FLOOD PREDICTIONS
Derivation of initial soil moisture accounting parameters from soil properties for the National Weather Service River Forecast System
[PB-210710/5] N78-29560
FLOODS
Nansen-Drift Station Project: Remote sea-ice runway construction
[AD-A054720] N78-29113
FLORIDA
Ground winds for Kennedy Space Center, Florida [1978 version]
[NASA-TM-78181] N78-29698
The effect of wind and dew point on vegetative wetting duration
[PB-280041/5] N78-29708
FLOW CHARACTERISTICS
Notes on the unsteady rectilinear motion of a perfect gas. Part 3: Homogeneous solutions of the Lagrangian equations of motion
[VTH-LR-258] N78-29419
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
FLOW DISTRIBUTION
A preliminary method for calculating the aerodynamic characteristics of cruciform missiles to high angles of attack including effects of roll angle and control deflections
[AD-A054349] N78-29070
Modification of the continuous flow diffusion chamber for use in zero-gravity --- atmospheric cloud physics lab
[NASA-CR-150765] N78-29123
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142
Mixing and combustion in high speed air flows --- combustor design
[AD-A054398] N78-29188
Simulation of saturated and unsaturated deformable porous media --- flow distribution and displacement in aquifiers
N78-29404
FLOW MEASUREMENT
An energy method for analyzing wave propagation in viscous flow in an elastic tube surrounded by an elastic medium
N78-29399
FLOW REGULATORS
Basic and practical investigations of automated stopped-flow mixing systems
N78-29172
FLOW STABILITY
Flow instability and acoustic radiation measurements of low Reynolds number supersonic jets
N78-29065
Photohydrodynamic stability near the Eddington limit
N78-30014
FLOW VELOCITY
Fluid motion in packed bed reactors --- measuring the displacement of particles and flow velocity
N78-29406
FLOWMETERS
Comparative testing of Niskin and Vector averaging current meters
[AD-A054113] N78-29428
Solid-state ultrasonic catheter-tip flowmeter
[AD-A050963] N78-29740
FLUID DYNAMICS
Fluid motion between two cylinders rotating at different speeds
N78-29394
Analysis of fluid dynamics during rapid depressurization of systems containing high enthalpy water
N78-29397
Slagging MHD generator: A parametric study
[SAND-77-1951] N78-29608
FLUID FLOW
Basic and practical investigations of automated stopped-flow mixing systems
N78-29172
Experimental study of the flow of drag reducing fluids in a narrow isosceles triangular duct
N78-29400
Fluid motion in packed bed reactors --- measuring the displacement of particles and flow velocity
N78-29406
Applications of cavitation analysis to design and operation of SPTF-HFL pump loops
[SAN/0700-1] N78-29460
FLUID MECHANICS
Liquid propellant reorientation in a low-gravity environment
[NASA-TM-78969] N78-29407
FLUIDIZED BED PROCESSORS
Fluid motion in packed bed reactors --- measuring the displacement of particles and flow velocity
N78-29406
Evaluation of a data base for a 100 MW coal burning power using pressurized fluidized bed combustion
[BMFT-FB-T-77-48] N78-29569
Heat transfer studies from single cylinder and tube bundle in fluidized bed
N78-29964
Numerical simulation and optimization of chemical processes-application to solid waste gasification --- optimizing a fluidized bed processor
N78-29990
FLUORESCENCE
Pulsed laser-excited fluorescence
N78-29160
Critical evaluation of some atom reservoirs for atomic fluorescence spectroscopy
N78-29165
FLUORINE COMPOUNDS
A preliminary investigation of the interaction of M-50 steel with a perfluoralkylether fluid and a 1 percent additive-fluid formulation
[AD-A054044] N78-29253
The electrical and optical properties of the system TiO[2-x]. The electrical, optical and photoconducting properties of Fe[2-x]Cr[x]Ob fo less than or equal to x less than or equal to 0.047]
[AD-A053858] N78-29961
FLUTTER
Investigation of the unsteady airloads on wing-store configurations in subsonic flow
[NLR-MP-77025-U] N78-29073
Effect of chordwise forces and deformations and deformations due to steady lift on wing flutter
[AD-A053640] N78-29110
FLYWHEELS
Current status of composite flywheel development
[UCRL-80604] N78-29605
Composite-rim flywheel design
[SAND-77-1061C] N78-29606
FOIL BEARINGS
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449
FORECASTING
Demand modelling of passenger air travel: An analysis and extension. Volume 1: Background and summary
[NASA-CR-157469] N78-29076
A new approach to ARMA modeling
N78-29814
FORESTS
Analysis of the dynamics of shifting cultivation in the tropical forests of Northern Thailand using LANDSAT modeling and classification of LANDSAT imagery
[E78-10178] N78-29534
FORMALDEHYDE
Shock tube studies of formaldehyde pyrolysis
[AD-A053695] N78-29185
FOURIER ANALYSIS
An investigation of the growth and decay of long and synoptic-scale waves
N78-29294
A statistical package for computing time and frequency domain analysis
[NASA-TM-56045] N78-29843
FOURIER TRANSFORMATION
Fourier-Wiener transforms of functionals of one and several Wiener variables
N78-29816
FRACTURE MECHANICS
Elastic-plastic crack closure analysis of Dugdale crack plates based on fatigue fracture mechanics
[REPT-30] N78-29489
Low cycle-fatigue and fracture behaviour as parameters for the dimensioning of high pressure vessels
[ICAF-1012] N78-29499
Fracture mechanics for structural adhesive bonds
[AD-A054023] N78-29509
FRACTURE STRENGTH
Pressureless sintered beta prime-Si3N4 solid solution: Fabrication, microstructure, and strength
[NASA-TM-78950] N78-29245
FRAGMENTATION
Intramolecular interactions in mass spectral fragmentation reactions
N78-29167
FREIGHT COSTS
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
FREQUENCY ANALYZERS
A statistical package for computing time and frequency domain analysis
[NASA-TM-56045] N78-29843
FREQUENCY DISTRIBUTION
A phase insensitive ultrasonic transducer --- annealing cadmium sulfide crystals
[NASA-CASE-LAR-12304-1] N78-29871
FREQUENCY MODULATION
Sample modulated Raman spectroscopy and frequency modulated visible light: Resonance Raman spectrum of a polydiacetylene fiber
[AD-A054674] N78-29187
Recording of measuring data on a cassette tape recorder using commercial FM components
[CSIR-TRANS-1401] N78-29425
FREQUENCY RANGES
Technique for dynamic range reduction for LANDSAT ratio images
[LA-UR-78-347] N78-29546
FREQUENCY SHIFT
Laser Doppler velocity simulator
[NASA-CASE-LAR-12176-1] N78-29435
FREQUENCY STABILITY
Singular perturbation of nonlinear regulators and systems with oscillatory modes
N78-29807
FREQUENCY STANDARDS
Disseminating standards of time and frequency: Issues in the evaluation of alternatives systems
[PB-279684/5] N78-29866
FRESNEL REFLECTORS
Image collapsing concentrators
[ALO-33] N78-29600
FRICTION
Oxygen and nitrogen diffusion in group V transition metals
N78-29205
FUEL CELLS
Solid Polymer Electrolyte [SPE] fuel cell technology program
[NASA-CR-151750] N78-29567
Assessment of fuel processing alternatives for fuel cell power generation
[EPRI-EM-570] N78-29596
National Fuel Cell Seminar. Program and abstracts
[CONF-770664-ABSTS] N78-29614
FUEL CONSUMPTION
Inducing the development and adoption of socially efficient automotive technology
[PB-279454/3] N78-29465
FUEL-AIR RATIO
Effect of air temperature and relative humidity at various fuel-air ratios on exhaust emissions on a per-mode basis of an AVCO Lycoming 0-320 diad light aircraft engine: Volume 1: Results and plotted data
[NASA-TM-73507-VOL-1] N78-29100
FUELS
Technical manual for the analysis
[PB-279196/0] N78-29272
FUNCTIONAL ANALYSIS
Procedures for functional partitioning and simulation of large digital systems
N78-29347
Computation of the irregularity-factor N sub o/N sub 1 of a stationary Gaussian process with dual peak power spectral density
[TB-137] N78-29501
A comparison of the axiomatic and functional models of structured programming
[AD-A053629] N78-29795
Fourier-Wiener transforms of functionals of one and several Wiener variables
N78-29816
FUNCTIONAL INTEGRATION
Relations among generalized Korteweg-DeVries systems
[AD-A054542] N78-29833
FUNCTIONALS
Fourier-Wiener transforms of functionals of one and several Wiener variables
N78-29816
FUNCTIONS [MATHEMATICS]
Function schemata
N78-29785
The geometry of differentiable functions on closed subsets of Euclidean space
N78-29857

The application of convex regularization to Tchebycheff systems
N78-29859
FUNGI
Methods for microbiological and immunological studies of space flight crews
[NASA-TM-58185] N78-29725
FUSION WELDING
Electron-beam fusion welding of beryllium
[RFP-2621] N78-29459

G

GALACTIC CLUSTERS
The galactic distribution of carbon monoxide: An out-of-plane survey
N78-30021
GALACTIC RADIATION
Energy spectrum of medium energy gamma-rays from the galactic center region --- experimental design
[NASA-TM-78331] N78-30035
The annihilation of galactic positrons
[NASA-TM-79600] N78-30037
GALAXIES
The chemical composition of galactic and extragalactic H II regions
N78-30019
A study of neutral hydrogen in early-type galaxies in the virgo cluster
N78-30020
GALERKIN METHOD
Analysis of evolutionary error in finite element and other methods
[AD-A054551] N78-29828
GALLIUM ARSENIDES
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
Annealing studies of beryllium in gallium arsenide and gallium arsenide phosphide
N78-29940
Thin film gallium arsenide solar cells and crystal structure determination by X-ray diffraction
N78-29953
GALLIUM PHOSPHIDES
Annealing studies of beryllium in gallium arsenide and gallium arsenide phosphide
N78-29940
GAMMA RAY ASTRONOMY
Energy spectrum of medium energy gamma-rays from the galactic center region --- experimental design
[NASA-TM-78331] N78-30035
GARP ATLANTIC TROPICAL EXPERIMENT
Variability of water temperature in the Atlantic near the equator --- GARP Atlantic Tropical Experiment
[BLLD-M-24959-[5828.4F]] N78-29717
GAS BEARINGS
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449
GAS DYNAMICS
Organic molecules in the atmosphere of Jupiter --- low molecular weight hydrocarbons
[NASA-CR-156793] N78-30026
GAS JETS
Neutralization of H[-] beams with gas jets
[BNL-23648] N78-29896
GAS LASERS
System optimization of gasdynamic lasers, computer program user's manual
[NASA-TM-73193] N78-29436
GAS TURBINE ENGINES
Long-term CF6 engine performance deterioration: Evaluation of engine S/N 451-380
[NASA-CR-159390] N78-29103
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215
Substitution of ceramics for high temperature alloys --- advantages of using silicon carbides and silicon nitrides in gas turbine engines
[NASA-TM-78931] N78-29246
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449
GAS TURBINES
Fluidic pressure ratio sensor
[AD-A054464] N78-29109
GAS-LIQUID INTERACTIONS
Experimental study of gas absorption into turbulent falling films of low surface tension liquids
N78-29395
GASIFICATION
Numerical simulation and optimization of chemical processes-application to solid waste gasification --- optimizing a fluidized bed processor
N78-29990
GEAR TEETH
Determination of bending stresses in a spur gear tooth
[RAE-LIB-TRANS-1923] N78-29452
GELS
The structure of amorphous hydrous erbium oxide gels
N78-29173
GEOLOGICAL FAULTS
Geothermic model for the rise of deeper groundwater along faults in unconsolidated rocks
[NP-22877] N78-29601
GEOLOGICAL SURVEYS
Geothermal reservoir categorization and stimulation study
[LA-6889-MS] N78-29547
GEOLOGY
HCMM: Soil moisture in relation to geologic structure and lithology, Northern California
[E78-10177] N78-29533
Project geological map to the millionth scale
[INPE-1074-NTE/100] N78-29540
Plane shock wave studies of geologic media
[UCRL-52357] N78-29687
GEOMAGNETIC TAIL
Observations pertaining to the dynamics of the plasma sheet
N78-29908
GEOMAGNETISM
Geomagnetic map of Spain for 1975
N78-29689
Geomagnetic data for April 1978: AE [8] indices and stacked magnetograms
[PB-280730/3] N78-29696
Solar-geophysical data no. 402, February 1978. Part 1: Prompt reports. Data for January 1978 - December 1977
[PB-280731/1] N78-30031
Solar-geophysical data No. 402, February 1978. Supplement: Explanation of data reports
[PB-280733/7] N78-30033
GEOMETRY
The geometry of differentiable functions on closed subsets of Euclidean space
N78-29857
GEOPHYSICS
Space research in the Republic of South Africa: Report to COSPAR --- on solar terrestrial physics and satellite remote sensing
N78-29125
Solar-geophysical data No. 402, February 1978. Supplement: Explanation of data reports
[PB-280733/7] N78-30033
GEOS 3 SATELLITE
The GEOS-3 orbit determination investigation
[NASA-CR-141441] N78-29127
GEOSYNCHRONOUS ORBITS
A seminumerical procedure for the calculation of geostationary orbit perturbations caused by the sun and the moon
[DLR-IB-552-77/23] N78-29130
GEOTHERMAL ENERGY CONVERSION
Alternate materials of construction for geothermal applications
[BNL-50751] N78-29611
Survey of models to predict the effect of geothermal power development on domestic water supplies and to design pollution monitoring methods
[UCRL-79977] N78-29637
GEOTHERMAL RESOURCES
Geothermal reservoir categorization and stimulation study
[LA-6889-MS] N78-29547
Conditioning of geothermal brine effluents for injection: Use of coagulants
[UCID-17716] N78-29609
GERMANY
Study of capital requirements, cost estimates and economic analysis of a SRC-II [Solvent Refined Coal] plant under conditions related to the Federal Republic of Germany
[BMFT-FB-T-77-64] N78-29582
GEYSERS
Liquid propellant reorientation in a low-gravity environment
[NASA-TM-78969] N78-29407
GHOSTS
Ghost analyzer for measuring TV ghost waves
[NHK-LABS-NOTE-223] N78-29300
GIRDERS
Computation of tensile stress in prestressed members due to cable restraint during detensioning
[PB-279391/7] N78-29526
GLACIOLOGY
Some elements of iceberg technology
[AD-A053431] N78-29679
GLASS
Impact vulnerability of scratched glass lenses
[AD-A053421] N78-29904
The effects of melt-crystal interface temperature rise on the analysis of crystal growth in binary borate glass melts
N78-29948
GLASS FIBERS
Tests of fabric filtration materials
[PB-279637/3] N78-29648
GLIDERS
Recording of measuring data on a cassette tape recorder using commercial FM components
[CSIR-TRANS-1401] N78-29425
GLYCINE
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals --- l-alanine, triglycine sulfate, and 3-hydroxyanthine
N78-29935
GOALS
Information service planning and evaluation: A goal programming approach
[AD-A054108] N78-29968
GOATS
Milk secretion of Zn-65 in the goat after oral intake of radiozinc
[FOA-C-40069-A3] N78-29731
Metabolism of 181W-labeled sodium tungstate in goats
[FOA-C-40070-A3] N78-29732
GOES SATELLITES
Automatic path delay corrections to GOES [Geostationary Operational Environmental Satellites] satellite time broadcasts
[PB-279335/4] N78-29334
GOVERNMENT/INDUSTRY RELATIONS
Technology transfer and other public policy implications of multi-national arrangements for the production of commercial airframes
[NASA-CR-159890] N78-29045
GRAIN BOUNDARIES
Grain boundary energetics in non-oxide ceramics
[AD-A054179] N78-29251
GRAMMARS
Succinctness of descriptions of context-free, regular and finite languages
N78-29788
GRANULAR MATERIALS
Ultrasonic attenuation as a function of heat treatment and grain size in 79Ni6Mo-15Fe alloy
[SAND-78-0144] N78-29280
GRAPHITE
Computer assisted characterization of a filament electrothermal atomizer
N78-29168
GRAPHITE-EPOXY COMPOSITE MATERIALS
Swelling of composite laminates
[AD-A053742] N78-29152
GRAPHS [CHARTS]
Geomagnetic data for April 1978: AE [8] indices and stacked magnetograms
[PB-280730/3] N78-29696
An examination of the weather graphics system [digital facsimile] acquisition
[AD-A053567] N78-29701
GREAT LAKES [NORTH AMERICA]
Ice on rivers and lakes: A bibliographic essay
[PB-279528/4] N78-29693
GRINDING [MATERIAL REMOVAL]
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902
GRIST [TELESCOPE]
Primary aberrations for grazing incidence
N78-29900
GROUND EFFECT
A theoretical investigation of ground effects on USB configurations
[NASA-CR-157355] N78-29086
GROUND STATE
High order contributions to the hyperfine structure in positronium and muonium
N78-29887
GROUND TRACKS
Radam phenomena of tracked vehicles
[AD-A053634] N78-29315
GROUND WATER
Geothermic model for the rise of deeper groundwater along faults in unconsolidated rocks
[NP-22877] N78-29601
GROUND WAVE PROPAGATION
Bibliography and comments on Loran-C ground wave propagation
[PB-279463/4] N78-29079
GROUND WIND
Ground winds for Kennedy Space Center, Florida [1978 version]
[NASA-TM-78181] N78-29698
GROUP THEORY
Strong convergence of semigroups of nonlinear contractions in Hilbert space
[AD-A054547] N78-29862
GULF OF MEXICO
Tracking and monitoring hurricanes by HF skywave radar over the Gulf of Mexico
[AD-A053638] N78-29702
Seasonal description of winds and surface and bottom salinities and temperatures in the northern Gulf of Mexico
[PB-280748/5] N78-29720

Data from the Atlantic Oceanographic and Meteorological Laboratories loop current monitoring cruises May 1975 through August 1976
[PB-280772/5] N78-29721

GUNN DIODES
Microwave oscillators. Citations from the engineering index data base
[NTIS/PS-78/0334/9] N78-29385
Gunn effect and transferred electron devices, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0361/2] N78-29388
Gunn effect devices, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0362/0] N78-29389

GYROSCOPES
Storage reliability of missile materiel program, gyroscope analysis
[AD-A053411] N78-29476

H

HADRONS
Phenomenology of neutral current interactions --- hadrons, bosons, neutrinos and weak energy interactions
N78-29888
The valence-core exchange model
N78-29945

HAIR
Tradescantia stamen hair: An introduction to the system and its use as a monitor atmospheric pollutants
[BNL-23829] N78-29635

HALIDES
The high pressure kinetics of a halide exchange reaction
N78-29163

HAMILTONIAN FUNCTIONS
Relations among generalized Korteweg-DeVries systems
[AD-A054542] N78-29833
Critical behavior of Reggeon field theory on a lattice --- using Hamiltonian formalism
N78-29944

HANDBOOKS
Technical manual for the analysis
[PB-279196/0] N78-29272

HARDNESS
The hardness and deformation of tungsten carbide-cobalt alloys
N78-29211

HARTREE APPROXIMATION
General multi-configuration Hartree-Fock program: MCHF77
[COO-4264-1] N78-29805

HEALTH PHYSICS
Efforts by the Environmental Protection Agency to protect the public from environmental nonionizing radiation exposures
[PB-279483/2] N78-29746

HEARING
Foreign noise research in noise effects. A survey of foreign noise effects research
[PB-279383/4] N78-29650

HEAT CAPACITY MAPPING MISSION
HCMM: Soil moisture in relation to geologic structure and lithology, Northern California
[E78-10177] N78-29533

HEAT EXCHANGERS
Estimation of the performance of shell and tube heat exchanger systems when uncertainties exist
N78-29396
Development of a ceramic tube heat exchanger with relaxing joint
[PE-2556-13] N78-29416
Development of a ceramic tube heat exchanger with relaxing joint
[PE-2556-14] N78-29417
Vibro-impact responses of a tube with tube-baffle interaction
[ANL-CT-78-11] N78-29510
Representative industrial solar energy installation, Northridge Hospital, Northridge, California
[UCRL-13789] N78-29613

HEAT OF VAPORIZATION
Flame efficiency, stabilization and performance in prevaporizing/premixing combustors
[AD-A053635] N78-29184

HEAT PIPES
CTS TEP thermal anomalies: Heat pipe system performance
[NASA-CR-159413] N78-29410
Theory and design of conventional heat pipes for space applications
[NLR-TR-77001-U] N78-29420

HEAT PUMPS
Design and installation package for a solar powered pump
[NASA-CR-150740] N78-29570

HEAT RESISTANT ALLOYS
Substitution of ceramics for high temperature alloys --- advantages of using silicon carbides and silicon nitrides in gas turbine engines
[NASA-TM-78931] N78-29246

HEAT STORAGE
Thermal energy storage for industrial waste heat recovery
[NASA-TM-78953] N78-29576

HEAT TRANSFER
Heat transfer during transition from film to nucleate boiling of water in force convection upward flow
N78-29398
Slagging MHD generator: A parametric study
[SAND-77-1951] N78-29608
Brine chemistry and combined heat/mass transfer, volume 1
[EPRI-ER-635-VOL-1] N78-29612
Heat transfer studies from single cylinder and tube bundle in fluidized bed
N78-29964
Heat transfer correlations for the nucleate, convective and dispersed regions of horizontal in-tube evaporation
N78-29965

HEAT TRANSMISSION
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946

HEAT TREATMENT
Ultrasonic attenuation as a function of heat treatment and grain size in 79Ni6Mo-15Fe alloy
[SAND-78-0144] N78-29280

HEATING EQUIPMENT
Energy conservation: Buildings, volume 1. A bibliography with abstracts
[NTIS/PS-78/0502/1] N78-29617
Energy conservation: Buildings, volume 2. A bibliography with abstracts
[NTIS/PS-78/0503/9] N78-29618

HEAVY LIFT HELICOPTERS
Heavy lift helicopter - advanced technology component program - rotor blade
[AD-A053423] N78-29089
HLH drive system
[AD-A054024] N78-29094

HELICOPTER DESIGN
Civil helicopter design and operational requirement
[NASA-CR-145377] N78-29083

HELICOPTER ENGINES
HLH drive system
[AD-A054024] N78-29094

HELICOPTER PERFORMANCE
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044

HELICOPTERS
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082

HELIUM FILM
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946

HELIUM ISOTOPES
Concentration susceptibility and the phase diagram of He3-He4 mixtures near the tricritical line
N78-29932
Nuclear magnetism of solid helium-three
N78-29934

HEOS B SATELLITE
Review of magnetospheric boundary layer phenomena and relations to current theories
[TRITA-EPP-77-25] N78-29691

HERMITIAN POLYNOMIAL
On a discrete Rodrigues' formula and a second class of orthogonal Hahn polynomials
[CTH-MATH-1977-12] N78-29864

HEWLETT-PACKARD COMPUTERS
Computer aided EMC analysis - a review of available tools
[NLR-TR-77070-U] N78-29331

HIERARCHIES
Hierarchical organization of distributed packet-switching communication systems
N78-29295
HDM: Command and staff overview
[AD-A054432] N78-29803

HIGH ALTITUDE BALLOONS
Dynamics of stratospheric winds in the Southern Hemisphere
[INPE-1065-PE/064] N78-29670

HIGH ENERGY ELECTRONS
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001

HIGH FREQUENCIES
HF channel simulator for wide band signals. A mathematical model and computer program for 100-kHz bandwidth HF channels
[AD-A054726] N78-29323

HIGH PRESSURE
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914

HIGH RESOLUTION
Tracking station for meteorological satellites with a high resolution radiometer
[INPE-1040-RAE/027] N78-29135
High resolution ultrasonic scanning of animal and human tissue in-vivo
[ORNL-TM-5934] N78-29742

HIGH SPEED
Dynamics of high-speed linkages with elastic members
N78-29448

HIGH STRENGTH ALLOYS
Creep of oxide dispersion strengthened materials [with special reference to TD nichrome]
[NASA-CR-135432] N78-29217
Thin film corrosion of anodized high-strength aluminum alloys
[AD-A054424] N78-29224

HIGH STRENGTH STEELS
Corrosion fatigue of high strength aircraft structural materials - crystallographic dependence of fracture path in Al-Zn-Mg [7075] alloys
[AD-A053743] N78-29221

HIGH TEMPERATURE
High temperature irradiation damage in nickel-chromium solid solutions
N78-29203
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632

HIGH TEMPERATURE PLASMAS
Limitations on lower hybrid heating of dense, hot plasmas
[GA-A-14783] N78-29923
Second Topical Conference on High-Temperature Plasma Diagnostics
[LA-7160C] N78-29927

HIGHLANDS
Solar radiation and its agricultural utilization on the hillsides of northeast Brazil
[INPE-1005-TPT/049] N78-29542

HIGHWAYS
Deicing-chemical rates on open-graded pavements: Studies in Maine, Michigan, Utah, and Vermont
[PB-279224/0] N78-29293
Skid resistance study
[PB-279588/8] N78-29464
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657
Inductive power coupling for an electric highway system --- supplying power to electric motor vehicles
[LBL-7262] N78-29998

HILBERT SPACE
Strong convergence of semigroups of nonlinear contractions in Hilbert space
[AD-A054547] N78-29862

HOLES (ELECTRON DEFICIENCIES)
A study of radiation effects in MOS capacitors
N78-29346

HOLOGRAPHIC INTERFEROMETRY
The deformation of steel bars in a four-point bending machine, measured by holographic interferometry
[NPL-MOM-27] N78-29517

HOLOGRAPHY
Image understanding research --- matching, radar imagery, and holograms
[AD-A054091] N78-29329

HOMOMORPHISMS
Regular transformation groups and homomorphisms
N78-29860

HORN ANTENNAS
Transients in resistively loaded antennas and their comparison with conical antennas and TEM horns
[PB-279640/7] N78-29335

HOT PRESSING
Structural evolution and electrical conductivity of sintered uranium dioxide
N78-29206

HOT WORKING
Examination of the mechanical properties of products of titanium alloys obtained by an original hot-working technique
[RAE-LIB-TRANS-1969] N78-29218

HOVERING STABILITY
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044

HUMAN BEHAVIOR
Human control and monitoring-models and experiments
[NLR-MP-76015-U] N78-29763

HUMAN FACTORS ENGINEERING
Man-machine interface analysis of the flight design system
[NASA-CR-151812] N78-29754
Integration and application of human resource technologies in weapon system design
[AD-A053681] N78-29756
Integration and application of human resource technologies in weapon system design: Coordination of five human resource technologies
[AD-A053680] N78-29757
A methodology for the ergonomic design of interactive computer graphic systems, and its application to crystallography
N78-29767

HUMAN RESOURCES
Integration and application of human resource technologies in weapon system design
[AD-A053681] N78-29756
HUMIDITY
Effect of air temperature and relative humidity at various fuel-air ratios on exhaust emissions on a per-mode basis of an AVCO Lycoming 0-320 diad light aircraft engine: Volume 1: Results and plotted data
[NASA-TM-73507-VOL-1] N78-29100
HURRICANES
Tracking and monitoring hurricanes by HF skywave radar over the Gulf of Mexico
[AD-A053638] N78-29702
HYBRID CIRCUITS
MNOS BORAM manufacturing methods and technology project
[AD-A054481] N78-29373
Manufacturing Methods and Technology Engineering [MM and TE] program for the establishment of production techniques for high density thick film circuits used in crystal oscillators
[AD-A054562] N78-29377
HYDRATION
Theoretical analysis of solvent effects on polymer conformation --- polypeptides and the hydration shell theory
N78-29238
HYDRAULIC EQUIPMENT
Storage reliability of missile materiel program. Storage reliability summary report. Volume 3: Hydraulic and pneumatic devices
[AD-A053409] N78-29471
HYDRAULICS
Hydraulic pressure pulses with elastic and plastic structural flexibility: Test and analysis [LWBR development program]
[WAPD-TM-1375] N78-29515
HYDRAZINES
Proceedings of the Conference on Environmental Chemistry of Hydrazine Fuels
[AD-A054194] N78-29261
Development and characterization of analysis methods for control of highly concentrated hydrazine --- rocket propellants
[FOA-C-20213-D3] N78-29264
HYDROBROMIC ACID
Anion exchange of 58 elements in hydrobromic acid and in hydriodic acid
[LA-7084] N78-29191
HYDROCARBONS
Remote-oxidation of flexible hydrocarbon chains
N78-29148
Organic molecules in the atmosphere of Jupiter --- low molecular weight hydrocarbons
[NASA-CR-156793] N78-30026
HYDRODYNAMICS
Hydrodynamic theories of relaxation in liquids
N78-29393
HYDROGEN
A spectroscopic investigation of the hydrogennitric oxide flame
N78-29178
Hydrogen content of hydrocarbon fuels by a low-resolution nuclear resonance method
[AD-A054465] N78-29262
Synthetic oil from coal: The economic impact of five alternatives for making hydrogen from coal
[PB-279322/2] N78-29273
A study of neutral hydrogen in early-type galaxies in the virgo cluster
N78-30020
HYDROGEN CHLORIDES
Solubility of hydrogen chloride and the kinetics of degradation of polyvinyl chloride
[BLL-PO-TRANS-3558-[7737.47]]
N78-29180
HYDROGEN CLOUDS
The chemical composition of galactic and extragalactic H II regions
N78-30019
HYDROGEN FUELS
Assessment of fuel processing alternatives for fuel cell power generation
[EPRI-EM-570] N78-29596
HYDROGEN IONS
Plasma neutralizer for H- beams
[BNL-23650] N78-29895
Neutralization of H[-] beams with gas jets
[BNL-23648] N78-29896
Development of H[-] sources at Brookhaven National Laboratory
[BNL-23651] N78-29897
HYDROGEN PLASMA
Plasma scattering experiments with a periodic Nd:YAG laser at 1.06 micron and a Si-avalanche detector
[IPF-78-2] N78-29446
Plasma neutralizer for H- beams
[BNL-23650] N78-29895
HYDROLOGY
Hydrologic simulation in a semi-arid region --- Jordon watershed model
N78-29527
Retransmission of hydrometric data in Canada
[E78-10174] N78-29531
Development of a subsurface hydrologic model and use for integrated management of surface and subsurface water resources
[PB-279629/0] N78-29554
Cooperative Instream Flow Service Group: The first year
[PB-279496/4] N78-29562
HYDROLOGY MODELS
Model studies of Lake Erie --- water circulation variations
N78-29528
Methodology for analyzing effects of urbanization on water resource systems
[PB-279663/9] N78-29557
HYDROMETEOROLOGY
Estimates from satellites of weather erosion parameters for reentry systems
[AD-A053654] N78-29136
HYDROMETERS
Summary of field support for SAMS VI and MSV operations
[AD-A054343] N78-29128
HYDROPHONES
Hydrophone preamplifier optimization: Prediction of hydrophone self-noise by a noise model
[AD-A053449] N78-29874
HYPERBOLIC DIFFERENTIAL EQUATIONS
Uniqueness of solutions to hyperbolic conservation laws
[AD-A054557] N78-29836
HYPERFINE STRUCTURE
High order contributions to the hyperfine structure in positronium and muonium
N78-29887

I

I BEAMS
Fatigue tests on I-beams of steel St 52-3
[FB-91] N78-29497
ICE
Ice crystal growth in a dynamic thermal diffusion chamber
N78-29662
ICEBERGS
Some elements of iceberg technology
[AD-A053431] N78-29679
IDEAL GAS
Notes on the unsteady rectilinear motion of a perfect gas. Part 3: Homogeneous solutions of the Lagrangian equations of motion
[VTH-LR-258] N78-29419
IDENTIFYING
A factor model of urban aerosol pollution: A new method of source identification
N78-29625
IMAGE CONTRAST
Impairment of picture signals and subjective quality in digital coding: Edge business visibility
[BLL-PO-TRANS-3516-[7737.47]]
N78-29298
IMAGE CORRELATORS
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906
IMAGE PROCESSING
Impairment of picture signals and subjective quality in digital coding: Edge business visibility
[BLL-PO-TRANS-3516-[7737.47]]
N78-29298
Concepts in real-time video tracking
[AD-A054475] N78-29320
Image understanding research --- matching, radar imagery, and holograms
[AD-A054091] N78-29329
Electronics engineering research proposals for FY78
[UCID-17711] N78-29379
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
IMAGE RESOLUTION
Image understanding research --- matching, radar imagery, and holograms
[AD-A054091] N78-29329
IMAGE TUBES
Modern ultrafast streak camera development and application review
[LA-UR-77-2474] N78-29429
IMMUNOLOGY
Methods for microbiological and immunological studies of space flight crews
[NASA-TM-58185] N78-29725
IMPACT RESISTANCE
Design of impact-resistant boron/aluminum large fan blade
[NASA-CR-135417] N78-29104
IMPACT TESTS
A model for thick-target projectile penetration based on instrumented-pressure-bar recording of penetration forces
[FOA-B-20016-D4] N78-29463
IMPEDANCE
The apparent resistance of aerials
[BLL-PO-TRANS-3538-[7737.47]]
N78-29341
IMPLANTATION
Bioelectrodes as sensors and as power sources for implantable medical devices
[BMFT-FB-T-77-44] N78-29736
IMPURITIES
Nonlinear order parameter fields. 1: Soliton dynamics. 2: Thermodynamics of a model impure system
N78-29963
IN-FLIGHT MONITORING
Human control and monitoring-models and experiments
[NLR-MP-76015-U] N78-29763
INCONEL [TRADEMARK]
Development of corrosion resistant fastening systems for aircraft carrier steam catapults
[AD-A053656] N78-29112
INDEPENDENT VARIABLES
Robust parameter estimators for communication data
[AD-A053901] N78-29317
On scattering diagnostics with periodically pulsed lasers to follow the continuous evolution of time dependent plasma parameters
[IPF-77-5] N78-29445
INDEXES [DOCUMENTATION]
Directory of transducer users
[AD-A053564] N78-29367
Union list of serials, 1977, second edition
[NASA-CR-156944] N78-29979
INDIAN SPACE PROGRAM
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124
INDIANA
Evaluation of wavelength groups for discrimination of agricultural cover types --- remote sensing of environment in INDIANA
[NASA-CR-157393] N78-29536
INDUCTION MOTORS
Inductive power coupling for an electric highway system --- supplying power to electric motor vehicles
[LBL-7262] N78-29998
INDUSTRIAL ENERGY
Energy conservation policy evaluation. Study module 1A, volume 2: Technical appendix
[PB-279664/7] N78-29620
INDUSTRIAL MANAGEMENT
Operations manual: Sludge handling and conditioning
[PB-279449/3] N78-30002
Package treatment plants: Operations manual
[PB-279444/4] N78-30004
INDUSTRIAL PLANTS
Study of capital requirements, cost estimates and economic analysis of a SRC-II [Solvent Refined Coal] plant under conditions related to the Federal Republic of Germany
[BMFT-FB-T-77-64] N78-29582
INDUSTRIAL WASTES
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the NTIS data base
[NTIS/PS-78/0499/0] N78-29266
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the American Petroleum Waste Institute data base
[NTIS/PS-78/0500/5] N78-29267
A study of the feasibility of utilizing solid wastes for building materials. Phase 1, summary report
[PB-279440/2] N78-29286
Thermal energy storage for industrial waste heat recovery
[NASA-TM-78953] N78-29576
St. Louis demonstration: Power plant equipment, facilities and environmental evaluations
[PB-279828/8] N78-29655
INERTIA
Powered inertia reel retraction during ejection
[AD-A054157] N78-29077
INFILTRATION
An experimental technique for vacuum infiltration of cracks with plastic and subsequent study in the scanning electron microscope
[VTH-LR-249] N78-29521
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
INFORMATION DISSEMINATION
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982
Solar terrestrial physics data exchange
[AD-A054101] N78-30030

INFORMATION MANAGEMENT
Management of Data Elements in Information Processing
[PB-279661/3] N78-29784
INFORMATION RETRIEVAL
Preliminary design of an accident Information Retrieval System [AIRS] --- using microprocessors for data storage in military helicopters
[HSER-7342] N78-29974
The visibility and impact of electronic storage and delivery of handbook-type information. Volume 1, part 1: Chapters 1-4. Part 2: Chapters 5 and appendices
[PB-278072/4] N78-29976
Timeliness and completeness of FBI responses to requests under freedom of information and privacy acts have improved
[PB-279416/2] N78-29984
INFORMATION SYSTEMS
Disk inventory system
[PB-280068/8] N78-29781
Information service planning and evaluation: A goal programming approach
[AD-A054108] N78-29968
Providing computer-based information services to an academic community
[PB-278330/6] N78-29975
The visibility and impact of electronic storage and delivery of handbook-type information. Volume 1, part 1: Chapters 1-4. Part 2: Chapters 5 and appendices
[PB-278072/4] N78-29976
Critical field experiments on uses of scientific and technical information
[PB-279693/6] N78-29980
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982
Timeliness and completeness of FBI responses to requests under freedom of information and privacy acts have improved
[PB-279416/2] N78-29984
Solar terrestrial physics data exchange
[AD-A054101] N78-30030
INFORMATION THEORY
Search and differentiation algorithms and information theory applied to chemical spectroscopic and biochemical data
N78-29169
Robust parameter estimators for communication data
[AD-A053901] N78-29317
INFRARED ASTRONOMY
Infrared studies of two dark clouds
N78-30017
INFRARED ASTRONOMY SATELLITE
IRAS on-board software
[NLR-MP-77037-U] N78-29138
INFRARED DETECTORS
Infrared techniques for nondestructive testing. Citations from the NTIS data base
[NTIS/PS-78/0358/8] N78-29484
Infrared techniques for nondestructive testing. Citations from the engineering index data base
[NTIS/PS-78/0359/6] N78-29485
INFRARED LASERS
Corneal damage thresholds for infrared laser exposure: Empirical data, model predictions, and safety standards
[AD-A049946] N78-29739
INFRARED RADIATION
The synthesis of substituted nickel dithiene complexes with intense electronic transitions in the infrared region
[AD-A054675] N78-29439
Molecular and particulate extinction in the atmosphere between 8 and 15 micrometers wavelength
[PB-280773/3] N78-29695
INFRARED RADIOMETERS
Infrared radiometer for measuring thermophysical properties of wind tunnel models
[NASA-CR-158898] N78-29426
INFRARED SPECTRA
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537
Possible new irdome materials for transmission to 4.5 - 5 micrometers
[AD-A053732] N78-29905
INFRARED SPECTROPHOTOMETERS
Far-infrared photometry with an 0.4-meter liquid helium cooled balloon-borne telescope
N78-30012
INFRARED SPECTROSCOPY
A study of the vibrational spectra of the partially-deuterated polycrystalline ethylenes
N78-29951
INPUT/OUTPUT ROUTINES
Modifications to the accuracy assessment analysis routine SPATL to produce an output file
[NASA-CR-151810] N78-29791
Updating the input-output matrix using mathematical methods
[INPE-1055-PE/062] N78-29792
INSECTICIDES
Topical hazard evaluation program of candidate insect repellent AI3-36331, US Department of Agriculture propriety compound
[AD-A054216] N78-29741
INSPECTION
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
INSTALLATION MANUALS
Installation package for integrated programmable electronic controller and hydronic subsystem - solar heating and cooling
[NASA-CR-150747] N78-29580
INSTRUMENT FLIGHT RULES
Verbal prescriptive rules in cognitive pretraining for the vertical S-A training maneuver
[AD-A050971] N78-29749
INSULATION
Kevlar 49-epoxy insulator
[SAND-77-0500] N78-29256
INTAKE SYSTEMS
Noise suppression in jet inlets
[AD-A054173] N78-29107
INTEGRATED CIRCUITS
KITCHIP: A superior low power monolithic device array
N78-29345
Integrated thin-film transistor display
[AD-A053627] N78-29358
Advanced electronic technology
[AD-A054478] N78-29374
Integrated circuits for managers
[SAND-77-0553C] N78-29378
Electronics engineering research proposals for FY78
[UCID-17711] N78-29379
Storage reliability of missile materiel program, monolithic bipolar SSI/MSI digital and linear integrated circuit analysis
[AD-A053415] N78-29479
Semiconductor measurement technology: Automated photomask inspection --- used in fabrication of integrated circuits
[PB-279336/2] N78-29488
INTEGRATORS
Propulsion/flight control integration technology [PROFIT] design analysis status
[NASA-CR-144875] N78-29101
INTEL 8080 MICROPROCESSOR
The microprocessor INTEL 8080 A and its use as digital filter
[DLR-IB-552-77/22] N78-29779
INTERFACE STABILITY
Mathematical and computational studies of equilibrium capillary free surfaces
[NASA-CR-135345] N78-29408
Mathematical and computational studies of the stability of axisymmetric annular capillary free surfaces
[NASA-CR-135346] N78-29409
INTERFACES
HP/MME terminal: Application specification
[AD-A054722] N78-29774
INTERFACIAL ENERGY
A study of radiation effects in MOS capacitors
N78-29346
INTERFACIAL TENSION
A mechanism for ultralow interfacial tension in systems containing microemulsions: Theoretical considerations and experiments with ultracentrifuge
N78-29175
Experimental study of gas absorption into turbulent falling films of low surface tension liquids
N78-29395
INTERGALACTIC MEDIA
The chemical composition of galactic and extragalactic H II regions
N78-30019
INTERNATIONAL COOPERATION
Canada report to COSPAR --- university research and space programs in Canada
N78-29126
INTERNATIONAL RELATIONS
The interdependence of nations: An agenda for research
[PB-279472/5] N78-29988
INTERPLANETARY GAS
Observations pertaining to the dynamics of the plasma sheet
N78-29908
INTERPLANETARY MAGNETIC FIELDS
Interplanetary magnetic holes: Theory
[NASA-TM-79599] N78-30023
Solar-geophysical data no. 402, February 1978. Part 1: Prompt reports. Data for January 1978 - December 1977
[PB-280731/1] N78-30031
Solar-geophysical data no. 402, February 1978. Part 2: Comprehensive reports. Data for August - July 1977 and miscellanea
[PB-280732/9] N78-30032
Solar-geophysical data No. 402, February 1978. Supplement: Explanation of data reports
[PB-280733/7] N78-30033
INTERPOLATION
Quadratic interpolation is risky
[AD-A054558] N78-29837
INTERSTELLAR GAS
The chemical composition of galactic and extragalactic H II regions
N78-30019
INTERSTELLAR TRAVEL
Laser driven light sails: An examination of the possibilities for interstellar probes and other missions
[NASA-CR-157362] N78-29117
INVENTORIES
Disk inventory system
[PB-280068/8] N78-29781
INVERSIONS
A new inversion method for remote sounding of planetary atmospheres --- spectral lines
[NASA-TM-79604] N78-30027
INVISCID FLOW
Calculation of pressure distribution, forces and moments for the fighter configuration IAe 60 by panel method
[DLR-IB-151-77/13] N78-29072
ION ACOUSTIC WAVES
A heating mechanism of ions due to large amplitude coherant ion acoustic wave
[IPPJ-333] N78-29912
ION BEAMS
Plasma neutralizer for H- beams
[BNL-23650] N78-29895
Neutralization of H[-] beams with gas jets
[BNL-23648] N78-29896
ION DENSITY (CONCENTRATION)
BENCHMARK-76: Model computations for disturbed atmospheric conditions. 3: Results for selected excitation parameters at 60 km
[AD-A054376] N78-29682
ION EXCHANGE MEMBRANE ELECTROLYTES
Solid Polymer Electrolyte [SPE] fuel cell technology program
[NASA-CR-151750] N78-29567
Anion permselective membrane
[NASA-CR-135316] N78-29574
ION EXCHANGE RESINS
Breadboard wash water renovation system --- using ferric chloride and ion exchange resins to remove soap and dissolved salts
[NASA-CR-151818] N78-29993
ION EXCHANGING
The high pressure kinetics of a halide exchange reaction
N78-29163
Anion exchange of 58 elements in hydrobromic acid and in hydriodic acid
[LA-7084] N78-29191
ION IRRADIATION
Direct observation of the point-defect structure of depleted-zones in ion-irradiated metals
N78-29213
ION PROPULSION
Engineering model 8-cm thruster subsystem
[NASA-CR-135406] N78-29147
ION SOURCES
Development of H[-] sources at Brookhaven National Laboratory
[BNL-23651] N78-29897
ION TEMPERATURE
A heating mechanism of ions due to large amplitude coherant ion acoustic wave
[IPPJ-333] N78-29912
IONIC DIFFUSION
Anomalous ion loss by low frequency instabilities
[IPPJ-334] N78-29913
IONIZATION
Application of negative chemical ionization mass spectrometry to the analysis of bovine tissue for chlorodibenzo-p-dioxins and related compounds
N78-29171
Calculation of electron binding energies --- ionization energies for water and neon and electron affinity of lithium hydride
N78-29882
IONIZING RADIATION
BEIRMOD, a computer program for calculating the effects of exposure to ionizing radiation
[PB-279584/7] N78-29747
IONOSPHERE
Energetic particles and ionization in the nighttime middle and low latitude ionosphere
[NASA-CR-156943] N78-29665
Nonlinear Landau damping in the ionosphere
[NASA-TM-79595] N78-29672
Numerical simulation of ionospheric and plasmaspheric dynamics
[AD-A053451] N78-29680
IONOSPHERIC CURRENTS
Ionospheric electrical fields
[INPE-1144-PE/098] N78-29676
IONOSPHERIC DISTURBANCES
BENCHMARK-76: Model computations for disturbed atmospheric conditions II. Results for the stratosphere and mesosphere
[AD-A054325] N78-29684

IONOSPHERIC ELECTRON DENSITY
BENCHMARK-76: Model computations for disturbed atmospheric conditions. 3: Results for selected excitation parameters at 60 km
[AD-A054376] N78-29682
BENCHMARK-76: Model computations for disturbed atmospheric conditions II. Results for the stratosphere and mesosphere
[AD-A054325] N78-29684
IONOSPHERIC ION DENSITY
BENCHMARK-76: Model computations for disturbed atmospheric conditions II. Results for the stratosphere and mesosphere
[AD-A054325] N78-29684
IONS
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889
IOWA
Thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border
[PB-279470/9] N78-29563
IRON
Investigations into the determination of trace levels of iron, Part 1: A field method for the determination of EDTA in natural water
N78-29159
Development of an iron-air battery system for electric vehicles
[TID-27914] N78-29604
IRON ALLOYS
Ultrasonic attenuation as a function of heat treatment and grain size in 79Ni6Mo-15Fe alloy
[SAND-78-0144] N78-29280
IRON CHLORIDES
Breadboard wash water renovation system --- using ferric chloride and ion exchange resins to remove soap and dissolved salts
[NASA-CR-151818] N78-29993
IRON COMPOUNDS
Synthesis, magnetic susceptibility, and Moessbauer spectra of Fe[III] dimers and Fe[II] polymers containing 2,5-dihydroxy-1,4-benzoquinones
[AD-A054678] N78-29250
IRON ISOTOPES
Observations and analysis of Fe 2 emission in Seyfert 1 galaxies and QSOs
N78-30015
IRRADIATION
High temperature irradiation damage in nickel-chromium solid solutions
N78-29203
BEIRMOD, a computer program for calculating the effects of exposure to ionizing radiation
[PB-279584/7] N78-29747
IRREVERSIBLE PROCESSES
Irreversible thermodynamic analysis of electrophoretic light scattering experiments
N78-29161
The importance of the Myocardial Depressant Factor [MDF] for the occurrence of irreversible shock. A literature study
[MBL-1977-5] N78-29743
ISOPERIMETRIC PROBLEM
Codimension one isometric immersions between Lorentz spaces
N78-29858
ISOTOPE SEPARATION
System analysis of plasma centrifuges and sputtering
[NASA-CR-135079] N78-29916
ITERATION
A Fubini theorem for iterated stochastic integrals
[AD-A054545] N78-29847
ITERATIVE SOLUTION
The implementation of implicit Runge-Kutta formulae for the solution of initial-value problems
[NPL-NAC-87] N78-29839

J

JAMMING
Electronic countermeasures and electronic counter countermeasures, volume 2: A bibliography with abstracts
[NTIS/PS-78/0337/2] N78-29333
JET AIRCRAFT
Assessment of atmospheric condensation nuclei associated with jet aircraft traffic
[AD-A054319] N78-29705
JET AIRCRAFT NOISE
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-1] N78-29867
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 2 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-2] N78-29868
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 3 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-3] N78-29869
Community noise exposure resulting from aircraft operations. Volume 1: Acoustic data on military aircraft
[AD-A053699] N78-29872
Community noise exposure resulting from aircraft operations. Volume 4: Acoustic data on Air Force trainer/fighter aircraft
[AD-A053702] N78-29873
JET CONTROL
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142
JET ENGINE FUELS
Hydrogen content of hydrocarbon fuels by a low-resolution nuclear resonance method
[AD-A054465] N78-29262
JET ENGINES
Noise suppression in jet inlets
[AD-A054173] N78-29107
JOINTS [JUNCTIONS]
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-13] N78-29416
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-14] N78-29417
JOURNAL BEARINGS
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449
JUPITER ATMOSPHERE
Organic molecules in the atmosphere of Jupiter --- low molecular weight hydrocarbons
[NASA-CR-156793] N78-30026

K

KALMAN FILTERS
Improving aided track performance during periods of tracker sensor failure by utilizing a target body fixed coordinate system
[AD-A053445] N78-29090
Advances in filtering techniques for stochastic systems with uncertain parameters, part I
[AD-A054396] N78-29844
KENTUCKY
Estimating environmental damages from surface mining of coal in Appalachia: A case study
[PB-279150/7] N78-29553
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
KINETIC ENERGY
An investigation of the growth and decay of long and synoptic-scale waves
N78-29294
KINETIC THEORY
Kinetic description of interaction of radiation with two- and three-level molecular systems
N78-29883

L

L-1011 AIRCRAFT
Development and flight evaluation of active controls in the L-1011 --- including wing load alleviation and stability augmentation
N78-29051
LABORATORIES
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978
[PB-279607/6] N78-29971
LAGOONS
Aeration of sewage lagoons, reservoirs, and streams. Citations from the engineering index data base
[NTIS/PS-78/0434/7] N78-29999
Aeration of sewage lagoons, reservoirs, and streams. Citations from the NTIS data base
[NTIS/PS-78/0433/9] N78-30000
LAKE ERIE
Model studies of Lake Erie --- water circulation variations
N78-29528
LAKE ICE
Ice on rivers and lakes: A bibliographic essay
[PB-279528/4] N78-29693
LAKES
The use of satellite imagery for lake classification in Wisconsin
[PB-279628/2] N78-29558
LAMINAR BOUNDARY LAYER
Mathematical theory of laminar combustion. 3: Perturbations
[AD-A054538] N78-29189
Mathematical theory of laminar combustion. 2: The premixed plane flame
[AD-A054537] N78-29190
LAMINAR FLOW
Cooperative Instream Flow Service Group: The first year
[PB-279496/4] N78-29562
LAMINATES
Swelling of composite laminates
[AD-A053742] N78-29152
Non Hookean behavior in the fiber direction of carbon fiber composites and the influence of fiber waviness on the tensile properties
[VTH-LR-251] N78-29157
LANDAU DAMPING
Nonlinear Landau damping in the ionosphere
[NASA-TM-79595] N78-29672
Lower hybrid wave heating experiments at General Atomic
[GA-A-14810] N78-29920
LANDING GEAR
Summary of NASA landing-gear research
N78-29056
Digital simulation of flexible aircraft response to symmetrical and asymmetrical runway roughness
[AD-A053588] N78-29087
Summary of landing gear initial flaws
[AD-A054048] N78-29095
LANDSAT 2
LANDSAT 2 world standard catalog, 1 Jan. - 30 Apr. 1978
[NASA-TM-79740] N78-29538
LANGUAGES
Machine translation. A bibliography with abstracts
[NTIS/PS-78/0448/7] N78-29977
LANTHANUM
Lifetimes of excited states of barium and lanthanum and the modification of the Hanle effect by strong optical pumping
N78-29884
LARGE AREA CROP INVENTORY EXPERIMENT
Crop forecasting by satellite: Progress and problems
[PB-279437/8] N78-29561
LARGE SCALE INTEGRATION
A differential input gainranging amplifier employing monolithic integrated circuits
[FOA-C-20221-E4] N78-29383
LASER APPLICATIONS
Laser driven light sails: An examination of the possibilities for interstellar probes and other missions
[NASA-CR-157362] N78-29117
Development of pumps for pulse compression laser applications
[AD-A054223] N78-29440
LASER DAMAGE
Thermal model of laser-induced skin damage: Computer program operator's manual
[AD-A053416] N78-29738
LASER DOPPLER VELOCIMETERS
Laser Doppler velocity simulator
[NASA-CASE-LAR-12176-1] N78-29435
Aerodynamic particle size measurement by laser-Doppler velocimetry
N78-29627
LASER FUSION
Radio chemistry as a diagnostic in laser fusion experiments
[UCRL-79778] N78-29442
Laser-fusion program at Los Alamos
[LA-UR-77-174] N78-29443
Laser fusion power balance measurements [particle transmission diagnostics]
[EPRI-ER-591] N78-29444
Tomography of laser fusion plasmas
[UCRL-79291] N78-29925
LASER PLASMAS
Plasma-laser interactions with solid poly-styrene microspheres
N78-29910
Tomography of laser fusion plasmas
[UCRL-79291] N78-29925
LASER PUMPING
Development of pumps for pulse compression laser applications
[AD-A054223] N78-29440
LASER RANGE FINDERS
Laser rangefinder/tank thermal sight integration study
[AD-A054622] N78-29438
LASER SPECTROSCOPY
Laser spectroscopy: Studies of the NO2 visible system
N78-29432
LASERS
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control

components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132
Focused laser beam scattering by stationary and moving particles: A theoretical study
N78-29433
Calculation of the laser induced Stark shifts in diatomic molecules
[AD-A053637] N78-29892
LATTICE PARAMETERS
Monte Carlo simulation of the classical two-dimensional one component plasma --- thermodynamic properties and lattice dynamics in the liquid and solid phases
[NASA-CR-157467] N78-29911
Critical behavior of Reggeon field theory on a lattice --- using Hamiltonian formalism
N78-29944
LAW [JURISPRUDENCE]
Analytical studies for the US Environmental Protection Agency. Volume 8. Noise abatement: Policy alternatives for transportation
[PB-279536/7] N78-29641
Timeliness and completeness of FBI responses to requests under freedom of information and privacy acts have improved
[PB-279416/2] N78-29984
LC CIRCUITS
A useful computer program for LC networks synthesis in time domain
[R-8-77] N78-29382
LEACHING
Active sites of dealuminated hydrogen mordenite
N78-29179
LEAD TELLURIDES
Electrical properties of Pb0.8Sn0.2Te spitaxial films
[AD-A053456] N78-29361
LEARNING MACHINES
A design for machine learning during continuous interaction with a simulated environment
N78-29771
LEAST SQUARES METHOD
Adaptive piecewise polynomial L1 approximation
[AD-A053651] N78-29822
Properties of ordinary and weighted least squares estimators of regression coefficients for two-stage samples
N78-29842
Reduction and smoothing of multivariate time series with curve fitting methods
[NLR-MP-77014-U] N78-29853
LEGIBILITY
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078
LENS DESIGN
Optical design of a coherent optical processor
N78-29899
LENSES
Impact vulnerability of scratched glass lenses
[AD-A053421] N78-29904
LEVITATION
Methods for the determination of gases in metals
[FOA-B-20009-D4[F3]] N78-29228
LIBRARIES
Providing computer-based information services to an academic community
[PB-278330/6] N78-29975
Union list of serials, 1977, second edition
[NASA-CR-156944] N78-29979
LIE GROUPS
Estimation and detection of Lie groups
[AD-A053633] N78-29821
LIFE [DURABILITY]
The construction of thermospheric density correction tables for use in satellite trajectory and lifetime predictions
[AD-A054341] N78-29129
Lifetimes of excited states of barium and lanthanum and the modification of the Hanle effect by strong optical pumping
N78-29884
LIFE CYCLE COSTS
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082
Avionics planning guidance: Executive summary
[AD-A054719] N78-29098
LIFE SCIENCES
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
LIFT
Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068
LIFT DRAG RATIO
A study of the lift-to-drag ratio capability of caret wing waveriders
[AD-A053691] N78-29069
LIGHT [VISIBLE RADIATION]
Sample modulated Raman spectroscopy and frequency modulated visible light: Resonance Raman spectrum of a polydiacetylene fiber
[AD-A054674] N78-29187
LIGHT BEAMS
Fabrication of light guides for astrophysics experiments
[NASA-TM-78099] N78-30036
LIGHT EMITTING DIODES
Thermal cycle testing of 7-segment light emitting diodes [LED] displays. [Test Evaluation]
[AD-A054418] N78-29369
Light emitting diodes for fiber optic communications --- fabrication
[AD-A053657] N78-29903
LIGHT SCATTERING
Irreversible thermodynamic analysis of electrophoretic light scattering experiments
N78-29161
Entangled polymers: Polystyrene in butanone
[SAND-77-1734C] N78-29255
Light scattering from Saturn's rings calculated by a Markov chain formalism
N78-30024
LIGHT WATER BREEDER REACTORS
Hydraulic pressure pulses with elastic and plastic structural flexibility: Test and analysis [LWBR development program]
[WAPD-TM-1375] N78-29515
LIGHTNING
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
LINE SPECTRA
A new inversion method for remote sounding of planetary atmospheres --- spectral lines
[NASA-TM-79604] N78-30027
LINEAR ACCELERATORS
Linear accelerator driven [LADR] and regenerative reactors [LARR] for nuclear non-proliferation
[BNL-50731] N78-29898
LINEAR EQUATIONS
A finite difference technique for solving optimization problems governed by linear functional differential equations
[AD-A053738] N78-29823
The application of convex regularization to Tchebycheff systems
N78-29859
LINEAR PROGRAMMING
Aggregation theory and its application to modeling in mathematical programming
[AD-A054061] N78-29802
LINEAR SYSTEMS
Linear equivalences in hereditary control systems
N78-29808
LINEARITY
Linear polybenzyl derivatives
N78-29239
LINKAGES
Dynamics of high-speed linkages with elastic members
N78-29448
LINKS
Communications Link Characterization Experiment [CLCE]
[NASA-CR-156784] N78-29308
LIQUID CHROMATOGRAPHY
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water --- using Amberlite ion exchange resins to trap oily pollutants in water
[AD-A053652] N78-29997
LIQUID CRYSTALS
Nuclear resonance in dispersed systems --- oil/water ratios in liquid crystals and microemulsions
N78-29950
Development of a multimode liquid-crystal light value
[AD-A054728] N78-29956
LIQUID METALS
Liquid metals as process solvents: Design techniques for magnesium oxide reduction
N78-29199
Soft-sphere model for liquid metals
[UCRL-52352] N78-29225
LIQUID PHASES
Monte Carlo simulation of the classical two-dimensional one component plasma --- thermodynamic properties and lattice dynamics in the liquid and solid phases
[NASA-CR-157467] N78-29911
LIQUID ROCKET PROPELLANTS
Liquid propellant reorientation in a low-gravity environment
[NASA-TM-78969] N78-29407
LIQUID SLOSHING
Mathematical and computational studies of the stability of axisymmetric annular capillary free surfaces
[NASA-CR-135346] N78-29409
LIQUID SURFACES
Fluid motion between two cylinders rotating at different speeds
N78-29394
LIQUID-SOLID INTERFACES
The effects of melt-crystal interface temperature rise on the analysis of crystal growth in binary borate glass melts
N78-29948
LIQUID-VAPOR EQUILIBRIUM
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Data and recommendations
[NPL-CHEM-79] N78-29193
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Fitting and correlation
[NPL-CHEM-80] N78-29194
LIQUID-VAPOR INTERFACES
Mathematical and computational studies of equilibrium capillary free surfaces
[NASA-CR-135345] N78-29408
Mathematical and computational studies of the stability of axisymmetric annular capillary free surfaces
[NASA-CR-135346] N78-29409
LIQUIDS
Hydrodynamic theories of relaxation in liquids
N78-29393
LITHIUM ALLOYS
Lithium-boron alloy anodes for molten salt batteries, I
[AD-A053621] N78-29587
LITHIUM HYDRIDES
Calculation of electron binding energies --- ionization energies for water and neon and electron affinity of lithium hydride
N78-29882
LITHOLOGY
HCMM: Soil moisture in relation to geologic structure and lithology, Northern California
[E78-10177] N78-29533
LOAD TESTS
Wear tests with PTFE-bearings at varying loads
[FFA-TN-HU-1755] N78-29462
LOADS [FORCES]
Assessment of service load experience using AIDS-recorded data
[NLR-MP-77011-U] N78-29096
Detailed application of a technology for the formulation and expression of standards applicable to the American National Standard Building Code requirements for minimum design loads in buildings and other structures [ANSI A58.1-1972]
[PB-279091/3] N78-29289
Inelastic bending of beams under time-varying moments: A state variable approach
[COO-2733-15] N78-29511
External loadings on nozzles in cylindrical shells
[CRIF-MT-122] N78-29520
LOGIC CIRCUITS
Design automation and testing of diagnosable MOS combinational logic networks
N78-29344
LOGISTICS MANAGEMENT
Avionics planning guidance: Executive summary
[AD-A054719] N78-29098
LONG ISLAND [NY]
Aquatic disposal field investigations, Eatons Neck disposal site, Long Island Sound. Appendix B: Water-quality parameters and physicochemical sediment parameters
[AD-A053427] N78-29630
LONG RANGE WEATHER FORECASTING
Climate change to the year 2000: A survey of expert opinion
[AD-A054208] N78-29707
LONG TERM EFFECTS
Long-term CF6 engine performance deterioration: Evaluation of engine S/N 451-380
[NASA-CR-159390] N78-29103
LOOPS
Non-flame atomic absorption spectroscopy employing a wire loop atomizer
N78-29166
LORAN C
Bibliography and comments on Loran-C ground wave propagation
[PB-279463/4] N78-29079
LOW ALTITUDE
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078
LOW ASPECT RATIO
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914
LOW CONCENTRATIONS
Measurement of small concentrations of pollutants in gases by an optical ac wavelength scanning method
[DLR-IB-453-78/1] N78-29196
LOW MOLECULAR WEIGHTS
Organic molecules in the atmosphere of Jupiter --- low molecular weight hydrocarbons
[NASA-CR-156793] N78-30026

LOW TEMPERATURE PHYSICS
Note on the cryostatic stability of superconducting composites n-- long wire concept
[ORNL-TM-5989] N78-29962
LOW TURBULENCE
Introduction to the kinetic theory of plasma turbulence
[INPE-1196-PE/112] N78-29917
LOWER ATMOSPHERE
Air chemistry measurements in the lower atmosphere made from a small aircraft - data presentation
[AC-42] N78-29692
LUBRICANTS
A preliminary investigation of the interaction of M-50 steel with a perfluoalkylether fluid and a 1 percent additive-fluid formulation
[AD-A054044] N78-29253
LUBRICATION
The role of temperature in EHD
[AD-A054320] N78-29454
LUGS
Fatigue testing of transversely loaded aluminium lugs, sequence 2
[FFA-TN-HU-1848] N78-29522
LUMINESCENCE
Nightglow mediums [5893A] and their correlation with atmospheric sodium concentration
[INPE-1032-PE/057] N78-29677
LUNAR ROCKS
Lunar breccias, petrology, and earth planetary structure
[NASA-CR-157361] N78-30028

M

MACHINE TRANSLATION
Machine translation. A bibliography with abstracts
[NTIS/PS-78/0448/7] N78-29977
MACHINING
Repair machining and inspection of cracked components
[NLR-MP-77018-U] N78-29483
MAGNESIUM
Adhesion of a bimetallic interface --- for Al, Mg, and Zn
[NASA-TM-78890] N78-29214
MAGNESIUM CHLORIDES
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197
MAGNESIUM OXIDES
Liquid metals as process solvents: Design techniques for magnesium oxide reduction
N78-29199
MAGNETIC DISKS
Disk inventory system
[PB-280068/8] N78-29781
MAGNETIC FIELDS
A new collective particle accelerator --- using density modulated, intense, relativistic electron beam in spatially modulated, magnetic field
[AD-A053759] N78-29893
Structure of magnetic field perturbations during the development of unsteady separation in the Tokamak-6 installation
[ORNL-TR-4528] N78-29924
MAGNETIC INDUCTION
Inductive power coupling for an electric highway system --- supplying power to electric motor vehicles
[LBL-7262] N78-29998
MAGNETIC MIRRORS
The dissipative trapped electron instability in the linear multi-mirror device
N78-29909
MAGNETIC PERMEABILITY
Nuclear magnetism of solid helium-three
N78-29934
MAGNETIC RECORDING
PCM video recording using a rotating magnetic sheet
[NHK-LABS-NOTE-221] N78-29423
MAGNETIC SIGNATURES
Geomagnetic data for April 1978: AE [8] indices and stacked magnetograms
[PB-280730/3] N78-29696
MAGNETIC TAPES
Direct access data migration system
[PB-280074/6] N78-29780
MAGNETIC VARIATIONS
Geomagnetic map of Spain for 1975
N78-29689
MAGNETICALLY TRAPPED PARTICLES
The dissipative trapped electron instability in the linear multi-mirror device
N78-29909
MAGNETOHYDRODYNAMIC FLOW
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914
MAGNETOHYDRODYNAMIC STABILITY
The dissipative trapped electron instability in the linear multi-mirror device
N78-29909
Anomalous ion loss by low frequency instabilities
[IPPJ-334] N78-29913
MAGNETOHYDRODYNAMIC TURBULENCE
Current-driven turbulence in plasmas
[REPT-77-106] N78-29929
MAGNETOHYDRODYNAMICS
Slagging MHD generator: A parametric study
[SAND-77-1951] N78-29608
MAGNETOPAUSE
Review of magnetospheric boundary layer phenomena and relations to current theories
[TRITA-EPP-77-25] N78-29691
MAGNETOSPHERE
Study of effects of space power satellites on life support functions of the earth's magnetosphere
[NASA-CR-156948] N78-29674
MAINTENANCE
Evaluation of the cumulative failure rate of a system: The optimal interval for preventive replacement of traveling wave tubes
[NHK-LABS-NOTE-222] N78-29342
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006
MAN MACHINE SYSTEMS
HP/MME terminal: Application specification
[AD-A054722] N78-29774
MANAGEMENT INFORMATION SYSTEMS
Management of Data Elements in Information Processing
[PB-279661/3] N78-29784
MANAGEMENT METHODS
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011
MANAGEMENT PLANNING
Navigation planning--need for a new direction
[PB-278627/5] N78-29080
Interface milestone management [IM2] concept
[PB-279252/1] N78-29970
Urban transportation economics: Proceedings of five workshops on pricing alternatives, economic regulations, labor issues, marketing, and government financing responsibilities
[PB-279689/4] N78-30009
MANPOWER
Integration and application of human resource technologies in weapon system design
[AD-A053681] N78-29756
MANUAL CONTROL
Human control and monitoring-models and experiments
[NLR-MP-76015-U] N78-29763
MANUFACTURING
Use of ultrasonics in manufacturing procedures. A bibliography with abstracts
[NTIS/PS-78/0483/4] N78-29881
MANY BODY PROBLEM
Use of operator equation of motion techniques in treating collective excitations
N78-29942
MAPPING
Investigating mapping techniques for elucidating processes occurring in pyrotechnic flames and their flame analogs
[AD-A053373] N78-29260
Project geological map to the millionth scale
[INPE-1074-NTE/100] N78-29540
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] N78-29545
Function schemata
N78-29785
MAPS
Geomagnetic map of Spain for 1975
N78-29689
MARINE BIOLOGY
Seagrass literature survey
[AD-A054480] N78-29729
Phytoplankton sampling in quantitative baseline and monitoring programs
[PB-279644/9] N78-29733
MARINE ENVIRONMENTS
Thin film corrosion of anodized high-strength aluminum alloys
[AD-A054424] N78-29224
Effectiveness of over-rust primer for Naval shore facilities
[AD-A053557] N78-29247
Scientific and technical publication of the Environmental Research Laboratories: Fiscal year 1976 [1 July 1975 through 30 September 1976]
[PB-280786/5] N78-29983
MARINE PROPULSION
Possible future marine fuels
[PB-279257/0] N78-29274
MARINER 10 SPACE PROBE
Atlas of Mercury --- Mariner 10 mission
[NASA-SP-423] N78-30025
MARKETING
Utilization of solar energy in developing countries: Identifying some potential markets
[NASA-TM-78964] N78-29578
Solar energy applications centers: A strategy to facilitate the commercialization of solar energy in New England
[HCP/M4007-01] N78-29592
MARKOV CHAINS
Light scattering from Saturn's rings calculated by a Markov chain formalism
N78-30024
MASERS
Prototype maser amplifiers for three milimeter wavelength
N78-29434
MASS SPECTRA
Intramolecular interactions in mass spectral fragmentation reactions
N78-29167
MASS SPECTROSCOPY
Thermodynamic properties of SeS
[LBL-6994] N78-29155
Application of negative chemical ionization mass spectrometry to the analysis of bovine tissue for chlorodibenzo-p-dioxins and related compounds
N78-29171
Molecular beam sampling mass spectrometry of high heating rate of HMX in a polyurethane binder
[AD-A054328] N78-29249
MASS TRANSFER
Brine chemistry and combined heat/mass transfer, volume I
[EPRI-ER-635-VOL-1] N78-29612
MATCHED FILTERS
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906
MATCHING
Image understanding research --- matching, radar imagery, and holograms
[AD-A054091] N78-29329
MATERIALS TESTS
Development of a laboratory data system executive summary
[PB-279765/2] N78-29782
MATHEMATICAL MODELS
A study of the lift-to-drag ratio capability of caret wing waveriders
[AD-A053691] N78-29069
Demand modelling of passenger air travel: An analysis and extension. Volume 1: Background and summary
[NASA-CR-157469] N78-29076
Packing, sintering and blending of binary powder mixtures
N78-29207
A model for thick-target projectile penetration based on instrumented-pressure-bar recording of penetration forces
[FOA-B-20016-D4] N78-29463
Development of a subsurface hydrologic model and use for integrated management of surface and subsurface water resources
[PB-279629/0] N78-29554
Thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border
[PB-279470/9] N78-29563
Incorporating uncertainty in energy supply models
[EPRI-EA-703-VOL-2] N78-29602
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632
Measurements at cooling tower plumes. Part 3: Three-dimensional measurements at cooling tower plumes
[ANL-TRANS-1117-PT-3] N78-29633
Comparison between flight test data and data from a theoretical model for the discovery of a ground target from the air
[FOA-C-56010-H9/H6] N78-29751
A multiparameter time domain averaging model of the human operator
[AD-A054676] N78-29758
Aggregation theory and its application to modeling in mathematical programming
[AD-A054061] N78-29802
A new approach to ARMA modeling
N78-29814
Estimation and identification for modeling dynamic systems
[AD-A053583] N78-29826
Singular perturbations, order reduction, and decoupling of large scale systems
[AD-A054483] N78-29829
Properties of ordinary and weighted least squares estimators of regression coefficients for two-stage samples
N78-29842
Moving average models: Time series in M-dimensions
[AD-A054585] N78-29849

Interrelationships between autoregressive and moving average models - the ARMA model: General considerations in M dimensions
[AD-A054587] N78-29852
The threshold point model
N78-29855
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
Numerical simulation and optimization of chemical processes-application to solid waste gasification --- optimizing a fluidized bed processor
N78-29990
A stirling engine computer model for performance calculations
[NASA-TM-78884] N78-29994
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011

MATHEMATICAL PROGRAMMING
The use of stochastic programming for the solution of some problems in statistics and probability
[AD-A054553] N78-29848

MATHEMATICS
Pure and applied mathematics in the People's Republic of China
[PB-279509/4] N78-29840

MATRICES [MATHEMATICS]
Efficient matrix transposition with limited high speed storage
[FOA-B-30021-E1] N78-29790
Updating the input-output matrix using mathematical methods
[INPE-1055-PE/062] N78-29792
The Bohl transformation and oscillation of linear differential systems
N78-29817
Some optimal properties and interpretations of principal components
[AD-A054555] N78-29834
An inverse regression method for determining an ensemble of state error vectors from a covariance matrix
[AD-A054214] N78-29845
Contributions to the theory of generalized block designs
N78-29854
Calculation of the laser induced Stark shifts in diatomic molecules
[AD-A053637] N78-29892

MATRIX THEORY
A variational equivalent to diagonal scaling
[AD-A054548] N78-29863

MAXIMUM LIKELIHOOD ESTIMATES
Multivariate linear functional relationships: Estimation of parameters and discrimination between two relationships, with a seismological application
[FOA-B-20015-T1] N78-29690
Adaptive minimum mean square error forecast of missile trajectory using stochastic difference equation models
[AD-A054540] N78-29846

MECHANICAL DRIVES
HLH drive system
[AD-A054024] N78-29094
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131

MECHANICAL PROPERTIES
Examination of the mechanical properties of products of titanium alloys obtained by an original hot-working technique
[RAE-LIB-TRANS-1969] N78-29218
Comparison of the microstructure and mechanical properties of 300-M steel manufactured by the vacuum arc remelt and the electroslag remelt processes
[LBL-6686] N78-29226

MEDICAL PHENOMENA
Medical evaluation of 2-pressure suit used in explosive decompressions up to 20.000 m altitude
[FOA-A-59002-H3] N78-29761

MELTING
The effects of melt-crystal interface temperature rise on the analysis of crystal growth in binary borate glass melts
N78-29948

MEMBRANE STRUCTURES
Polymeric replamineform biomaterials and a new membrane structure
N78-29241

MEMBRANES
Penetration of solvents in plastic material
[FOA-C-20201-H2] N78-29258

MERCURY [METAL]
Experimental studies of interfacial electro chemistry
N78-29158
Mercury pollution, volume 1. A bibliography with abstracts
[NTIS/PS-78/0479/2] N78-29642
Mercury pollution, volume 2. A bibliography with abstracts
[NTIS/PS-78/0480/0] N78-29643
Biological effects of mercury pollution. A bibliography with abstracts
[NTIS/PS-78/0496/6] N78-29651

MERCURY [PLANET]
Atlas of Mercury --- Mariner 10 mission
[NASA-SP-423] N78-30025

MERCURY COMPOUNDS
Part 1: A recirculating charge-coupled device. Part 2: The mercury selenide on N-silicon Schottky barrier
N78-29933

MESOSPHERE
Simultaneous observations of the Na 5893A
[INPE-1081-PE/067] N78-29667

METABOLISM
Metabolism of 181W-labeled sodium tungstate in goats
[FOA-C-40070-A3] N78-29732

METAL BONDING
Electronic structure of equiatomic alloys of aluminum with iron, cobalt and nickel
N78-29212
Adhesion of a bimetallic interface --- for Al, Mg, and Zn
[NASA-TM-78890] N78-29214

METAL COATINGS
Tin plating and tin plate. Citations from the NTIS data base
[NTIS/PS-78/0477/6] N78-29232
Tin plating and tin plate. Citations from the engineering index data base
[NTIS/PS-78/0478/4] N78-29233
Tapered roller bearing development for aircraft turbine engines
[AD-A054045] N78-29458

METAL CRYSTALS
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936
Energy transfer and dissipation processes in doped crystals
N78-29941

METAL FATIGUE
Repair machining and inspection of cracked components
[NLR-MP-77018-U] N78-29483

METAL IONS
Electrical properties and structure of BaO-B2O3-SiO2 glass containing titanium ions
N78-29204

METAL OXIDE SEMICONDUCTORS
Design automation and testing of diagnosable MOS combinational logic networks
N78-29344
A study of radiation effects in MOS capacitors
N78-29346
MNOS BORAM manufacturing methods and technology project
[AD-A054481] N78-29373
Integrated circuits for managers
[SAND-77-0553C] N78-29378

METAL OXIDES
Reactions of yttria-stabilized zirconia with oxides and sulfates of various elements
[NASA-TM-78942] N78-29216

METAL PARTICLES
Nuclear spin-lattice relaxation in small metallic particles
N78-29937

METAL PLATES
Automatic control of weld penetration
[AD-A054026] N78-29456

METAL-GAS SYSTEMS
Methods for the determination of gases in metals
[FOA-B-20009-D4[F3]] N78-29228

METALS
Methods for the determination of gases in metals
[FOA-B-20009-D4[F3]] N78-29228

METEOROLOGICAL PARAMETERS
Overview of safety research
N78-29054
Communications Link Characterization Experiment [CLCE]
[NASA-CR-156784] N78-29308
The 1977 NRL air quality data
[AD-A054634] N78-29631
Procedures to accomplish quality control of meteorological altitude data
[INPE-1037-NTE/089] N78-29700
Atmospheric structure White Sands Missile Range, New Mexico. Part 6: 25-65 kilometers
[AD-A053568] N78-29704
Tropical wave dynamics
[AD-A054302] N78-29706

METEOROLOGICAL RADAR
Tracking and monitoring hurricanes by HF skywave radar over the Gulf of Mexico
[AD-A053638] N78-29702
Spring program '76. Section 1: Meteorological summary. Section 2: Doppler radar data quality control summary
[PB-280745/1] N78-29714

METEOROLOGICAL SATELLITES
Tracking station for meteorological satellites with a high resolution radiometer
[INPE-1040-RAE/027] N78-29135
Estimates from satellites of weather erosion parameters for reentry systems
[AD-A053654] N78-29136

METEOROLOGY
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124

METHANE
Metastable diamond synthesis and the rate of carbon formation on diamond
N78-29237
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661

METHYL ALCOHOLS
Methanol as a possible fuel for automotive use
[TT-7708] N78-29259
Evaluation of sulfur-tolerant catalytic processes for producing peak-shaving alcohol fuels
[EPRI-AF-687] N78-29263

MICE
Influence of microwaves within the thermal intensity range in mice. Weight, rectal temperature, respiration, tread mill activity, reaction of senses, and learning
[FOA-C-54018-H2/H6] N78-29730

MICHELSON INTERFEROMETERS
TEA laser emission on the sequence bands of CO2
[AD-A054149] N78-29437

MICROANALYSIS
Dispersive and nondispersive analysis: Comparison of the two techniques used in microanalysis by means of an electron microprobe
[BLL-PO-TRANS-3531-[7737.47]]
N78-29422

MICROORGANISMS
Methods for microbiological and immunological studies of space flight crews
[NASA-TM-58185] N78-29725

MICROPHOTOGRAPHS
Microscopic study of stress corrosion crack growth in an AlZnMg alloy
[NLR-MP-77004-U] N78-29518

MICROPROCESSORS
RS-600 programmable controller: Solar heating and cooling
[NASA-CR-150744] N78-29579
Installation package for integrated programmable electronic controller and hydronic subsystem - solar heating and cooling
[NASA-CR-150747] N78-29580
Intelligence security subsystem
[AD-A054508] N78-29776
Fiber optics and microprocessors: A control-system solution for the laser-fusion environment
[LA-UR-78-329] N78-29777
Preliminary design of an accident Information Retrieval System [AIRS] --- using microprocessors for data storage in military helicopters
[HSER-7342] N78-29974

MICROSTRUCTURE
Structural evolution and electrical conductivity of sintered uranium dioxide
N78-29206
The effects of microstructural features on the response of aluminum alloys to cyclic deformation
[AD-A053649] N78-29220
Comparison of the microstructure and mechanical properties of 300-M steel manufactured by the vacuum arc remelt and the electroslag remelt processes
[LBL-6686] N78-29226
Pressureless sintered beta prime-Si3N4 solid solution: Fabrication, microstructure, and strength
[NASA-TM-78950] N78-29245

MICROWAVE AMPLIFIERS
Defense satellite communications system traveling Wave Tube Amplifier life test report. Volume 1: Twenty watt TWTA
[AD-A053739] N78-29360

MICROWAVE OSCILLATORS
Microwave oscillators, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0333/1] N78-29384
Microwave oscillators. Citations from the engineering index data base
[NTIS/PS-78/0334/9] N78-29385
Gunn effect devices, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0362/0] N78-29389

MICROWAVE RADIOMETERS
Advanced microwave radiometer antenna system study
[NASA-CR-156776] N78-29304

MICROWAVE RESONANCE
Microwave absorption studies near the plasma frequency
[LA-UR-78-51] N78-29928

MICROWAVE SCANNING BEAM LANDING SYSTEM
Ultrasonic simulation of MSBLS multipath fading for orbiter landing configuration
[NASA-CR-151752] N78-29302
MICROWAVE SCATTERING
Research of microwave scattering properties of snow fields
[NASA-CR-157472] N78-29303
MICROWAVE TRANSMISSION
Propagation of microwave satellite communication signals through striated media
[AD-A054677] N78-29324
Satellite Power System [SPS] concept development and evaluation program plan, July 1977 - August 1980
[NASA-TM-79400] N78-29593
MICROWAVES
Gain degradation and amplitude scintillation due to tropospheric turbulence
[NASA-CR-156796] N78-29668
Influence of microwaves within the thermal intensity range in mice. Weight, rectal temperature, respiration, tread mill activity, reaction of senses, and learning
[FOA-C-54018-H2/H6] N78-29730
Biological effects of microwaves. A bibliography with abstracts
[NTIS/PS-78/0432/1] N78-29745
MILITARY AIRCRAFT
Aircraft military utility and functional tests
[AD-A053617] N78-29091
Community noise exposure resulting from aircraft operations. Volume 1: Acoustic data on military aircraft
[AD-A053699] N78-29872
Simple empirical cost model for aircraft --- fly-away prices for civil and military aircraft
[FOA-C-20205-D8[M4]] N78-29986
MILITARY HELICOPTERS
Preliminary design of an accident Information Retrieval System [AIRS] --- using microprocessors for data storage in military helicopters
[HSER-7342] N78-29974
MILITARY OPERATIONS
Simulators in education and training, volume 2. A bibliography with abstracts
[NTIS/PS-78/0378/6] N78-29752
Simulators in education and training volume 3. A bibliography with abstracts
[NTIS/PS-78/0379/4] N78-29753
MILITARY VEHICLES
Vehicular intercommunications system
[AD-A054021] N78-29327
MILK
Milk secretion of Zn-65 in the goat after oral intake of radiozinc
[FOA-C-40069-A3] N78-29731
MILLIMETER WAVES
A compendium of millimeter wave propagation studies performed by NASA
[NASA-CR-156781] N78-29309
MINERAL DEPOSITS
Western gas sands project
[NVO/0655-100] N78-29597
MINES [EXCAVATIONS]
Deep ocean mining and the ecology of the tropical north Pacific
[PB-279988/0] N78-29722
MINICOMPUTERS
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] N78-29545
MINING
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0423/0] N78-29551
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0424/8] N78-29552
MISSILE COMPONENTS
Storage reliability of missile materiel program. Storage reliability analysis summary report. Volume 1: Electrical and electronic devices
[AD-A053405] N78-29470
Storage reliability of missile materiel program. Storage reliability summary report. Volume 3: Hydraulic and pneumatic devices
[AD-A053409] N78-29471
Storage reliability of missile materiel program. Storage reliability summary report. Volume 4: Ordnance devices
[AD-A053406] N78-29472
Storage reliability of missile materiel program. Storage reliability summary report. Volume 5: Optical and electro-optical devices
[AD-A053407] N78-29473
Storage reliability of missile materiel program, electronic vacuum tube analysis
[AD-A053402] N78-29474
Storage reliability of missile materiel program. Missile material reliability prediction handbook, parts count prediction
[AD-A053403] N78-29475
Storage reliability of missile materiel program, gyroscope analysis
[AD-A053411] N78-29476
Storage reliability of missile materiel program, accelerometer analysis
[AD-A053412] N78-29477
Storage reliability of missile materiel program, relay analysis
[AD-A053413] N78-29478
Storage reliability of missile materiel program, monolithic bipolar SSI/MSI digital and linear integrated circuit analysis
[AD-A053415] N78-29479
Storage reliability of missile materiel program, switch analysis
[AD-A053414] N78-29480
Storage reliability of missile materiel program, missile systems battery analysis
[AD-A053410] N78-29481
MISSILE STORAGE
Storage reliability of missile materiel program, gyroscope analysis
[AD-A053411] N78-29476
MISSILE TRAJECTORIES
Adaptive minimum mean square error forecast of missile trajectory using stochastic difference equation models
[AD-A054540] N78-29846
MISSION PLANNING
Technical data requirements for shipboard and shorebased vertical/short takeoff and landing V/STOL aircraft
[AD-A054102] N78-29093
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
MISSISSIPPI RIVER [US]
Thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border
[PB-279470/9] N78-29563
MISSOURI RIVER [US]
Thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border
[PB-279470/9] N78-29563
MIXING
Basic and practical investigations of automated stopped-flow mixing systems
N78-29172
MODELS
Soft-sphere model for liquid metals
[UCRL-52352] N78-29225
Hydrologic simulation in a semi-arid region --- Jordon watershed model
N78-29527
MOISTURE CONTENT
Swelling of composite laminates
[AD-A053742] N78-29152
MOLECULAR CHAINS
Remote-oxidation of flexible hydrocarbon chains
N78-29148
MOLECULAR COLLISIONS
On the possibility of negative activation energies in bimolecular reactions
[NASA-TM-78509] N78-29149
Kinetic description of interaction of radiation with two- and three-level molecular systems
N78-29883
Collisional stabilization of chemically activated molecules --- cyclic hydrocarbons
N78-29891
MOLECULAR ENERGY LEVELS
On the possibility of negative activation energies in bimolecular reactions
[NASA-TM-78509] N78-29149
MOLECULAR EXCITATION
Selection rule effects in electronic excitations of chemisorbed molecules as studied by energy loss spectroscopy
[AD-A054105] N78-29894
Energy transfer and dissipation processes in doped crystals
N78-29941
MOLECULAR GASES
Organic molecules in the atmosphere of Jupiter --- low molecular weight hydrocarbons
[NASA-CR-156793] N78-30026
MOLECULAR INTERACTIONS
Intramolecular interactions in mass spectral fragmentation reactions
N78-29167
A molecular dynamics study of a system of hard spherocylinders
N78-29890
MOLECULAR OSCILLATIONS
A molecular dynamics study of a system of hard spherocylinders
N78-29890
MOLECULAR STRUCTURE
Electrical properties and structure of BaO-B2O3-SiO2 glass containing titanium ions
N78-29204
Kinetic description of interaction of radiation with two- and three-level molecular systems
N78-29883
Techniques of macromolecular crystallography
N78-29949
MOLECULAR WEIGHT
Linear polybenzyl derivatives
N78-29239
MOLYBDENUM
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936
MONTE CARLO METHOD
Estimation of the performance of shell and tube heat exchanger systems when uncertainties exist
N78-29396
Monte Carlo simulation of the classical two-dimensional one component plasma --- thermodynamic properties and lattice dynamics in the liquid and solid phases
[NASA-CR-157467] N78-29911
MORPHOLOGY
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
MOTOR VEHICLES
Inducing the development and adoption of socially efficient automotive technology
[PB-279454/3] N78-29465
MOVING TARGET INDICATORS
Tradeoff of hardware and signal-to-noise ratio in moving target indicators
[AD-A054727] N78-29322
MULTICHANNEL COMMUNICATION
HF channel simulator for wide band signals. A mathematical model and computer program for 100-kHz bandwidth HF channels
[AD-A054726] N78-29323
MULTIPATH TRANSMISSION
Ultrasonic simulation of MSBLS multipath fading for orbiter landing configuration
[NASA-CR-151752] N78-29302
MULTIPLE BEAM INTERVAL SCANNERS
Bandwidth limitations on achievable cancellation for adaptive nulling systems
[AD-A054160] N78-29326
MULTIPROCESSING [COMPUTERS]
Further results regarding multiprocessor systems
N78-29769
MULTISPECTRAL BAND SCANNERS
Advanced Multispectral Scanner [AMS] study --- aircraft remote sensing
[NASA-CR-151753] N78-29424
Evaluation of wavelength groups for discrimination of agricultural cover types --- remote sensing of environment in INDIANA
[NASA-CR-157393] N78-29536
MULTISPECTRAL PHOTOGRAPHY
Introduction to a multispectral data analysis system
[INPE-1227-NTE/115] N78-29541
MULTIVARIATE STATISTICAL ANALYSIS
Multivariate linear functional relationships: Estimation of parameters and discrimination between two relationships, with a seismological application
[FOA-B-20015-T1] N78-29690
Reduction and smoothing of multivariate time series with curve fitting methods
[NLR-MP-77014-U] N78-29853
MUONS
High order contributions to the hyperfine structure in positronium and muonium
N78-29887
MYOCARDIUM
The importance of the Myocardial Depressant Factor [MDF] for the occurrence of irreversible shock. A literature study
[MBL-1977-5] N78-29743

N

NACELLES
Winglet and long duct nacelle aerodynamic development for DC-10 derivatives
N78-29049
NASA PROGRAMS
Summary of NASA landing-gear research
N78-29056
A compendium of millimeter wave propagation studies performed by NASA
[NASA-CR-156781] N78-29309
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
NASTRAN
Effect of steady flight loads on JT9D-7 performance deterioration
[NASA-CR-135407] N78-29105
The NASTRAN programmer's manual [level 16.0]
[NASA-SP-223[03]] N78-29505
The NASTRAN user's manual: Level 16.0 supplement
[NASA-SP-222[03]] N78-29506
NATIONS
The interdependence of nations: An agenda for research
[PB-279472/5] N78-29988

NATURAL GAS
Western gas sands project
[NVO/0655-100] N78-29597
NAVIGATION SATELLITES
Navigation planning--need for a new direction
[PB-278627/5] N78-29080
NEODYMIUM COMPOUNDS
Solid state formation of Nd:Y sub 3 Al sub 5 O sub 12 Nd YAG
[AD-A054428] N78-29959
NEODYMIUM LASERS
Manufacturing methods and technology engineering for neodymium doped YAG laser rods
[AD-A054224] N78-29441
NEON
Calculation of electron binding energies --- ionization energies for water and neon and electron affinity of lithium hydride
N78-29882
NETWORK ANALYSIS
The design of all-passes, low-passes and band-passes with a constant group delay approximated according to Chebishev
[CSIR-TRANS-1402] N78-29305
NETWORK SYNTHESIS
Design automation and testing of diagnosable MOS combinational logic networks
N78-29344
A useful computer program for LC networks synthesis in time domain
[R-8-77] N78-29382
Large change sensitivity figure and new algorithm for its minimization
[R-9-77] N78-29856
NEUTRAL BEAMS
Neutralization of H[-] beams with gas jets
[BNL-23648] N78-29896
NEUTRALIZERS
Plasma neutralizer for H- beams
[BNL-23650] N78-29895
NEUTRINOS
Phenomenology of neutral current interactions --- hadrons, bosons, neutrinos and weak energy interactions
N78-29888
NEUTRON FLUX DENSITY
Current and neutron yield scaling of fast high voltage plasma focus
[IPF-77-2] N78-29930
NEW MEXICO
Laser-fusion program at Los Alamos
[LA-UR-77-174] N78-29443
Atmospheric structure White Sands Missile Range, New Mexico. Part 6: 25-65 kilometers
[AD-A053568] N78-29704
NEWS MEDIA
Facsimile communication and electronic mail system by satellite in Iran and other developing nations
N78-29301
NICKEL
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
High temperature irradiation damage in nickel-chromium solid solutions
N78-29203
Electronic structure of equiatomic alloys of aluminum with iron, cobalt and nickel
N78-29212
NICKEL ALLOYS
Methanation activity of Raney nickel catalysts: Effect of proportion of NiAAl3 and Ni2Al3 in precursor alloys
[PB-279656/3] N78-29198
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215
NICKEL COMPOUNDS
Electron microscopy of crystalline and amorphous electrodeposited thin Ni-P films
N78-29208
The synthesis of substituted nickel dithiene complexes with intense electronic transitions in the infrared region
[AD-A054675] N78-29439
Thermal dynamic properties of NiBr2 and NiSO4 from 10 to 1,200 K
[PB-279646/4] N78-29966
NIOBIUM
Diffusion welding multifilament superconductive composites
[UCRL-80436] N78-29156
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955
NIOBIUM ALLOYS
Thermodynamics of oxygen in solid solution in vanadium and niobium-vanadium alloys
N78-29174
NITRIC OXIDE
A spectroscopic investigation of the hydrogennitric oxide flame
N78-29178
NITROGEN
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
NITROGEN OXIDES
Laser spectroscopy: Studies of the NO2 visible system
N78-29432
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661
NOCTURNAL VARIATIONS
Nightglow mediums [5893A] and their correlation with atmospheric sodium concentration
[INPE-1032-PE/057] N78-29677
NOISE [SOUND]
Foreign noise research in noise effects. A survey of foreign noise effects research
[PB-279383/4] N78-29650
NOISE GENERATORS
An investigation of rotor noise generation by aerodynamic disturbance --- aeroacoustic transfer functions
[NASA-CR-157571] N78-29870
NOISE INTENSITY
Noise suppression in jet inlets
[AD-A054173] N78-29107
NOISE MEASUREMENT
Community noise exposure resulting from aircraft operations. Volume 1: Acoustic data on military aircraft
[AD-A053699] N78-29872
Community noise exposure resulting from aircraft operations. Volume 4: Acoustic data on Air Force trainer/fighter aircraft
[AD-A053702] N78-29873
The prediction of aerodynamic and wheel/rail noise generated by high-speed trains
[DLR-IB-257-77/14] N78-29877
NOISE POLLUTION
Analytical studies for the US Environmental Protection Agency. Volume 8. Noise abatement: Policy alternatives for transportation
[PB-279536/7] N78-29641
Foreign noise research in noise effects. A survey of foreign noise effects research
[PB-279383/4] N78-29650
NOISE REDUCTION
Noise suppression in jet inlets
[AD-A054173] N78-29107
Analyzing X-ray valence band spectra by mathematical methods. Discussion and investigation of noise reduction, differentiation and deconvolution of spectra
[UCRL-TRANS-11326] N78-29227
Magneto-optic detection system with noise cancellation
[NASA-CASE-NPO-11954-1] N78-29421
Analytical studies for the US Environmental Protection Agency. Volume 8. Noise abatement: Policy alternatives for transportation
[PB-279536/7] N78-29641
Suppression of perforated wall in a transonic wind tunnel and the effects on aerodynamic data
[AD-A054417] N78-29876
NOISE THRESHOLD
Hydrophone preamplifier optimization: Prediction of hydrophone self-noise by a noise model
[AD-A053449] N78-29874
NONDESTRUCTIVE TESTS
Water vapor permeability of plastic fast packs
[AD-A054509] N78-29254
Infrared techniques for nondestructive testing. Citations from the NTIS data base
[NTIS/PS-78/0358/8] N78-29484
Infrared techniques for nondestructive testing. Citations from the engineering index data base
[NTIS/PS-78/0359/6] N78-29485
NONLINEAR EQUATIONS
Nonlinear deformations and static buckling
[ESA-TT-478] N78-29524
The finite element method applied to a class of time-dependent nonlinear partial differential equations
[TN-21] N78-29819
Stability properties of a nonlinear differential system in applied mathematics
[CTH-MATH-1977-15] N78-29865
NONLINEAR PROGRAMMING
Decomposition in fixed point computation --- operations research and optimization
[AD-A053439] N78-29797
Quadratic interpolation is risky
[AD-A054558] N78-29837
NONLINEARITY
Nonlinear analysis of plasma instability excited by the auroral electrojet
[AD-A053647] N78-29678
Nonlinear order parameter fields. 1: Soliton dynamics. 2: Thermodynamics of a model impure system
N78-29963
NONUNIFORM PLASMAS
Anomalous ion loss by low frequency instabilities
[IPPJ-334] N78-29913
NONUNIFORMITY
Effects of geometric nonuniformities on the stresses in piping elbows
[WARD-SD-3045-7] N78-29513
NORMAL SHOCK WAVES
Application of normal mode theory to seismic source and structure problems: Seismic investigations of upper mantle lateral heterogeneity
[NASA-CR-157354] N78-29673
NORTH AMERICA
Watershed Research in Eastern North America. Volume 1: A workshop to compare results
[PB-279919/5] N78-29549
Watershed Research in Eastern North America. Volume 2: A workshop to compare results
[PB-279920/3] N78-29550
NOSE CONES
Summary of field support for SAMS VI and MSV operations
[AD-A054343] N78-29128
NOZZLE FLOW
Aerodynamic particle size measurement by laser-Doppler velocimetry
N78-29627
NOZZLES
External loadings on nozzles in cylindrical shells
[CRIF-MT-122] N78-29520
NUCLEAR EXPLOSIONS
Estimate of earth media shear strength at the Nevada Test Site
[UCRL-52358] N78-29688
NUCLEAR MAGNETIC RESONANCE
Hydrogen content of hydrocarbon fuels by a low-resolution nuclear resonance method
[AD-A054465] N78-29262
Self diffusion in cells and tissues
[AD-A053422] N78-29727
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889
Nuclear magnetism of solid helium-three
N78-29934
Nuclear resonance in dispersed systems --- oil/water ratios in liquid crystals and microemulsions
N78-29950
NUCLEAR PROPULSION
Nuclear Bi-Brayton system for aircraft propulsion study
[AD-A054672] N78-29106
NUCLEAR REACTORS
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632
NUCLEAR SPIN
Nuclear spin-lattice relaxation in small metallic particles
N78-29937
NUCLEATION
Assessment of atmospheric condensation nuclei associated with jet aircraft traffic
[AD-A054319] N78-29705
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947
Heat transfer correlations for the nucleate, convective and dispersed regions of horizontal in-tube evaporation
N78-29965
NULL HYPOTHESIS
A study of correlation among error terms of a repeated measures design
N78-29815
NUMERICAL ANALYSIS
A seminumerical procedure for the calculation of geostationary orbit perturbations caused by the sun and the moon
[DLR-IB-552-77/23] N78-29130
The design of all-passes, low-passes and band-passes with a constant group delay approximated according to Chebishev
[CSIR-TRANS-1402] N78-29305
Mathematical and computational studies of equilibrium capillary free surfaces
[NASA-CR-135345] N78-29408
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering --- problem solving methods at the University of Houston
[NASA-CR-157364] N78-29820
Analytic theory of orbit contraction
[NASA-CR-157359] N78-30022
NUMERICAL CONTROL
Dynamic model for computer control of the extrusion of solid dielectric cable
[EPRI-EL-605] N78-29381
NUMERICAL INTEGRATION
Runge-Kutta formulas with extended regions of stability
N78-29818

NUMERICAL WEATHER FORECASTING
Atmospheric prediction model survey
[NASA-CR-157217] N78-29697
Probability of low and high temperatures in Tennessee
[PB-280741/0] N78-29710

O

OCEAN CURRENTS
Ocean thermal and current velocity data requirements for design of an OTEC Demonstration plant
[PB-280728/7] N78-29622
Data from the Atlantic Oceanographic and Meteorological Laboratories loop current monitoring cruises May 1975 through August 1976
[PB-280772/5] N78-29721
OCEAN THERMAL ENERGY CONVERSION
Ocean thermal and current velocity data requirements for design of an OTEC Demonstration plant
[PB-280728/7] N78-29622
OCEANOGRAPHIC PARAMETERS
Coastal upwelling ecosystems analysis. JOINT-II, the Thompson sections: R/V T. G. Thompson cruise 108
[PB-279173/9] N78-29718
OCEANOGRAPHY
Seasonal description of winds and surface and bottom salinities and temperatures in the northern Gulf of Mexico
[PB-280748/5] N78-29720
Data from the Atlantic Oceanographic and Meteorological Laboratories loop current monitoring cruises May 1975 through August 1976
[PB-280772/5] N78-29721
Deep ocean mining and the ecology of the tropical north Pacific
[PB-279988/0] N78-29722
OCULOMOTOR NERVES
The processing of velocity information by the pursuit oculomotor system
N78-29735
ODORS
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654
OHMIC DISSIPATION
GAC-ANL TNS scoping studies. Volume 11: TNS doublet Tokamak ohmic-heating power supply study --- Tokamak reactor technology
[GA-A-14614-VOL-11] N78-29919
OIL EXPLORATION
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0423/0] N78-29551
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0424/8] N78-29552
Western gas sands project
[NVO/0655-100] N78-29597
OIL POLLUTION
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water --- using Amberlite ion exchange resins to trap oily pollutants in water
[AD-A053652] N78-29997
OIL SLICKS
The air quality and oil spill implications of Alaskan oil importation into Southern California
N78-29626
OILS
Nuclear resonance in dispersed systems --- oil/water ratios in liquid crystals and microemulsions
N78-29950
ON-LINE PROGRAMMING
HP/MME terminal: Application specification
[AD-A054722] N78-29774
Disk inventory system
[PB-280068/8] N78-29781
OPERATIONS RESEARCH
Decomposition in fixed point computation --- operations research and optimization
[AD-A053439] N78-29797
OPERATORS (MATHEMATICS)
Use of operator equation of motion techniques in treating collective excitations
N78-29942
OPTICAL COMMUNICATION
Light emitting diodes for fiber optic communications --- fabrication
[AD-A053657] N78-29903
OPTICAL DATA PROCESSING
Space-variant coherent optical processing
N78-29901
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906
OPTICAL EQUIPMENT
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902
OPTICAL FILTERS
Optical design of a coherent optical processor
N78-29899
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906
OPTICAL MEASUREMENT
Measurements at cooling tower plumes. Part 3: Three-dimensional measurements at cooling tower plumes
[ANL-TRANS-1117-PT-3] N78-29633
OPTICAL PROPERTIES
Optical design of a coherent optical processor
N78-29899
Possible new irdome materials for transmission to 4.5 - 5 micrometers
[AD-A053732] N78-29905
OPTICAL PUMPING
Lifetimes of excited states of barium and lanthanum and the modification of the Hanle effect by strong optical pumping
N78-29884
OPTICAL SCANNERS
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
Measurement of small concentrations of pollutants in gases by an optical ac wavelength scanning method
[DLR-IB-453-78/1] N78-29196
OPTICAL TRACKING
The processing of velocity information by the pursuit oculomotor system
N78-29735
OPTICAL WAVEGUIDES
Fabrication of light guides for astrophysics experiments
[NASA-TM-78099] N78-30036
OPTIMAL CONTROL
State estimation and optimal control of distributed parameter systems
N78-29177
Singular perturbation of nonlinear regulators and systems with oscillatory modes
N78-29807
Singular perturbations, order reduction, and decoupling of large scale systems
[AD-A054483] N78-29829
OPTIMIZATION
Spacelab Level 4 programmatic Implementation Assessment Study. Volume 3: Optimization and programmatics
[NASA-CR-145348-VOL-3] N78-29121
Discrete structural optimization
N78-29490
Decomposition in fixed point computation --- operations research and optimization
[AD-A053439] N78-29797
A finite difference technique for solving optimization problems governed by linear functional differential equations
[AD-A053738] N78-29823
Some optimal properties and interpretations of principal components
[AD-A054555] N78-29834
Numerical simulation and optimization of chemical processes-application to solid waste gasification --- optimizing a fluidized bed processor
N78-29990
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006
ORBIT CALCULATION
Analytic theory of orbit contraction
[NASA-CR-157359] N78-30022
ORBIT PERTURBATION
A seminumerical procedure for the calculation of geostationary orbit perturbations caused by the sun and the moon
[DLR-IB-552-77/23] N78-29130
Introduction to the kinetic theory of plasma turbulence
[INPE-1196-PE/112] N78-29917
ORBITAL MECHANICS
Analytic theory of orbit contraction
[NASA-CR-157359] N78-30022
ORDNANCE
Storage reliability of missile materiel program. Storage reliability summary report. Volume 4: Ordnance devices
[AD-A053406] N78-29472
ORGANIC COMPOUNDS
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197
Evaluation of a technique for sampling low concentrations of organic vapors in ambient air
[PB-279672/0] N78-29652
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water --- using Amberlite ion exchange resins to trap oily pollutants in water
[AD-A053652] N78-29997
ORGANIC NITRATES
Sources and characteristics of soluable organic nitrogen in activated-sludge effluents
N78-29991
ORGANIC SILICON COMPOUNDS
Chemical reactions and properties of organosilicon compounds related to new materials
[AD-A053672] N78-29150
ORGANIZATIONS
Canada report to COSPAR --- university research and space programs in Canada
N78-29126
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978
[PB-279607/6] N78-29971
Report of the science applications task force to the director of the National Science Foundation
[PB-279458/4] N78-29972
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information --- organizations and information sources for technology utilization in developing countries
[PB-279193/7] N78-29981
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982
ORGANOMETALLIC COMPOUNDS
Theoretical and experimental studies of reactivity and bonding of transition-metal organometallic compounds
N78-29201
ORIENTATION
The effect of sample orientation on flame spread across polyurethane foams
N78-29181
ORTHOGONAL FUNCTIONS
On a discrete Rodrigues' formula and a second class of orthogonal Hahn polynomials
[CTH-MATH-1977-12] N78-29864
ORTHOGONALITY
A set of orthogonal polynomials that generalize the racah coefficients or 6 -J symbols
[AD-A054552] N78-29835
OSCILLATIONS
Investigations of the transonic flow around oscillating airfoils
[NLR-TR-77090-U] N78-29074
Singular perturbation of nonlinear regulators and systems with oscillatory modes
N78-29807
The Bohl transformation and oscillation of linear differential systems
N78-29817
OSMOSIS
Anion permselective membrane
[NASA-CR-135316] N78-29574
OV-1 SATELLITES
Compilation of scientific results from the satellite OVI-17
[AD-A050483] N78-29137
OXIDATION
Remote-oxidation of flexible hydrocarbon chains
N78-29148
OXIDATION RESISTANCE
Hot corrosion and oxidation studies on cobalt-based alloys
[AD-A053745] N78-29222
Testing the stability of high-density polyethylene --- oxidation resistance, weathering, and durability
[BLL-PO-TRANS-3564-(7737.47)]
N78-29243
OXIDES
Creep of oxide dispersion strengthened materials (with special reference to TD nichrome)
[NASA-CR-135432] N78-29217
OXYGEN
Thermodynamics of oxygen in solid solution in vanadium and niobium-vanadium alloys
N78-29174
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661

P

PACIFIC NORTHWEST (US)
Integrating policy analysis
[PB-279217/4] N78-29621

PACIFIC OCEAN
Coastal upwelling ecosystems analysis. JOINT-II, the Thompson sections: R/V T. G. Thompson cruise 108
[PB-279173/9] N78-29718
Deep ocean mining and the ecology of the tropical north Pacific
[PB-279988/0] N78-29722
PACKAGING
Water vapor permeability of plastic fast packs
[AD-A054509] N78-29254
PARAMETERIZATION
State estimation and optimal control of distributed parameter systems
N78-29177
Function schemata
N78-29785
PARTIAL DIFFERENTIAL EQUATIONS
The finite element method applied to a class of time-dependent nonlinear partial differential equations
[TN-21] N78-29819
PARTICLE ACCELERATORS
A new collective particle accelerator --- using density modulated, intense, relativistic electron beam in spatially modulated, magnetic field
[AD-A053759] N78-29893
PARTICLE INTERACTIONS
Nonlinear Landau damping in the ionosphere
[NASA-TM-79595] N78-29672
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889
The valence-core exchange model
N78-29945
PARTICLE SIZE DISTRIBUTION
Determination of particle size distribution of salt crystals in aqueous slurries
[RHO-SA-5] N78-29192
PARTICLE TELESCOPES
An experimental study of the chemical composition of the heavy cosmic ray nuclei
N78-30034
PARTICLE TRAJECTORIES
Fluid motion in packed bed reactors --- measuring the displacement of particles and flow velocity
N78-29406
PARTICULATE SAMPLING
A factor model of urban aerosol pollution: A new method of source identification
N78-29625
PASSENGER AIRCRAFT
Demand modelling of passenger air travel: An analysis and extension. Volume 1: Background and summary
[NASA-CR-157469] N78-29076
Civil helicopter design and operational requirement
[NASA-CR-145377] N78-29083
PASSENGERS
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-2] N78-29996
PATTERN RECOGNITION
Concepts in real-time video tracking
[AD-A054475] N78-29320
Evaluation of wavelength groups for discrimination of agricultural cover types --- remote sensing of environment in INDIANA
[NASA-CR-157393] N78-29536
Decision rules and decision tree approach in pattern recognition theory
N78-29809
The computation of immediate texture discrimination
[AD-A053804] N78-29810
PAVEMENTS
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
Design and performance of pavement overlays
[PB-279523/5] N78-29284
Analysis of full depth AC pavements using layered elastic theory
[PB-279386/7] N78-29291
Vibration of unreinforced pavement concrete
[PB-279148/1] N78-29292
Deicing-chemical rates on open-graded pavements: Studies in Maine, Michigan, Utah, and Vermont
[PB-279224/0] N78-29293
Computer simulation of the effect of road roughness on tire-pavement forces in braking and cornering
[PB-279887/4] N78-29466
PAYLOADS
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 1: Representative payload definition
[NASA-CR-145348-VOL-1] N78-29119
PENETRATION
Penetration of solvents in plastic material
[FOA-C-20201-H2] N78-29258
Automatic control of weld penetration
[AD-A054026] N78-29456
PERFORMANCE
Field manual for performance evaluation and troubleshooting at municipal wastewater treatment facilities
[PB-279448/5] N78-30003
PERFORMANCE PREDICTION
Effect of steady flight loads on JT9D-7 performance deterioration
[NASA-CR-135407] N78-29105
Estimation of the performance of shell and tube heat exchanger systems when uncertainties exist
N78-29396
PERFORMANCE TESTS
Long-term CF6 engine performance deterioration: Evaluation of engine S/N 451-380
[NASA-CR-159390] N78-29103
A temperature controlled water bath for viscosity measurement
[NPL-MOM-24] N78-29281
Investigation on a slow running centrifugal pump at different Reynolds numbers
[BLL-RTS-10585] N78-29402
Test and evaluation of an aluminum oxide ball and seat in a ball valve
[MERC/RI-77/3] N78-29461
Respirator studies for the Nuclear Regulatory Commission. Protection Factors for supplied-air respirators
[LA-7098-PR] N78-29760
A stirling engine computer model for performance calculations
[NASA-TM-78884] N78-29994
PERIODIC VARIATIONS
Model studies of Lake Erie --- water circulation variations
N78-29528
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3 --- periodic variations
[NASA-TM-79605] N78-30018
PERMEABILITY
Water vapor permeability of plastic fast packs
[AD-A054509] N78-29254
Self diffusion in cells and tissues
[AD-A053422] N78-29727
PERSONALITY TESTS
Pilot workload analysis based upon in-flight physiological measurements and task analysis methods
[NLR-MP-76001-U] N78-29762
PERSONNEL DEVELOPMENT
Simulators in education and training, volume 2. A bibliography with abstracts
[NTIS/PS-78/0378/6] N78-29752
Simulators in education and training volume 3. A bibliography with abstracts
[NTIS/PS-78/0379/4] N78-29753
PERTURBATION THEORY
Investigations of the transonic flow around oscillating airfoils
[NLR-TR-77090-U] N78-29074
A seminumerical procedure for the calculation of geostationary orbit perturbations caused by the sun and the moon
[DLR-IB-552-77/23] N78-29130
Fluid motion between two cylinders rotating at different speeds
N78-29394
Singular perturbations, order reduction, and decoupling of large scale systems
[AD-A054483] N78-29829
Structure of magnetic field perturbations during the development of unsteady separation in the Tokamak-6 installation
[ORNL-TR-4528] N78-29924
Nonlinear order parameter fields. 1: Soliton dynamics. 2: Thermodynamics of a model impure system
N78-29963
PETROLEUM PRODUCTS
Desulfurization of coal and petroleum, volume 2. A bibliography with abstracts
[NTIS/PS-78/0497/4] N78-29270
PETROLOGY
Lunar breccias, petrology, and earth planetary structure
[NASA-CR-157361] N78-30028
PHASE DIAGRAMS
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
PHASE MODULATION
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328
PHASE SHIFT CIRCUITS
Phase shifters. Citations from the engineering data base
[NTIS/PS-78/0471/9] N78-29390
Phase shifters, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0469/3-VOL-2] N78-29391
Phase shifters, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0470/1] N78-29392
PHASE TRANSFORMATIONS
Heat transfer during transition from film to nucleate boiling of water in force convection upward flow
N78-29398
PHASED ARRAYS
The optimization of self-phased arrays for diurnal motion tracking of synchronous satellites
[NASA-CR-156795] N78-29134
Radar-77
[AD-A053624] N78-29314
Phased arrays, volume 3. Citations from the NTIS data base
[NTIS/PS-78/0331/5] N78-29386
Phased arrays. Citations from the engineering index data base
[NTIS/PS-78/0332/3] N78-29387
PHOSPHORIC ACID
National Fuel Cell Seminar. Program and abstracts
[CONF-770664-ABSTS] N78-29614
PHOSPHORUS COMPOUNDS
Electron microscopy of crystalline and amorphous electrodeposited thin Ni-P films
N78-29208
PHOTOABSORPTION
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661
PHOTOELECTRIC MATERIALS
The electrical and optical properties of the system TiO[2-x]. The electrical, optical and photoconducting properties of Fe[2-x]Cr[x]Ob (o less than or equal to x less than or equal to 0.047]
[AD-A053858] N78-29961
PHOTOGRAMMETRY
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] N78-29529
PHOTOINTERPRETATION
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] N78-29529
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
PHOTOIONIZATION
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661
PHOTOMAPS
Atlas of Mercury --- Mariner 10 mission
[NASA-SP-423] N78-30025
PHOTOMETERS
Magneto-optic detection system with noise cancellation
[NASA-CASE-NPO-11954-1] N78-29421
PHOTONS
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
Light scattering from Saturn's rings calculated by a Markov chain formalism
N78-30024
PHOTOVOLTAIC CELLS
Performance and stability analysis of a photovoltaic power system
[NASA-TM-78880] N78-29566
PHOTOVOLTAIC CONVERSION
Improved semiconductors for photovoltaic solar cells
[DSE/2457-4] N78-29595
Improved semiconductors for photovoltaic solar cells
[DSE/2457-5] N78-29759
PHYSIOLOGICAL EFFECTS
Foreign noise research in noise effects. A survey of foreign noise effects research
[PB-279383/4] N78-29650
PHYSIOLOGICAL TESTS
Medical evaluation of 2-pressure suit used in explosive decompressions up to 20.000 m altitude
[FOA-A-59002-H3] N78-29761
Pilot workload analysis based upon in-flight physiological measurements and task analysis methods
[NLR-MP-76001-U] N78-29762
PIEZOELECTRIC CRYSTALS
A phase insensitive ultrasonic transducer --- annealing cadmium sulfide crystals
[NASA-CASE-LAR-12304-1] N78-29871
Surface acoustic wave scattering from grooves in piezoelectric substrates
N78-29952
PIEZOELECTRICITY
Production Engineering Measure [PEM]: Manufacturing methods and technology for piezoelectric transformers
[AD-A054177] N78-29371
On the influence of a flexural biasing state on the velocity of piezoelectric surface waves
[AD-A054397] N78-29957

PILOT PERFORMANCE
Measuring pilot proficiency on an instrument training maneuver
[AD-A050972] N78-29755
A multiparameter time domain averaging model of the human operator
[AD-A054676] N78-29758
Pilot workload analysis based upon in-flight physiological measurements and task analysis methods
[NLR-MP-76001-U] N78-29762
Human control and monitoring-models and experiments
[NLR-MP-76015-U] N78-29763
PILOT TRAINING
Alternatives for future undergraduate pilot training
[AD-A053374] N78-29750
PIPE FLOW
An energy method for analyzing wave propagation in viscous flow in an elastic tube surrounded by an elastic medium
N78-29399
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
PIPELINES
Pipeline corrosion. Citations from the NTIS data base
[NTIS/PS-78/0453/7] N78-29229
Pipeline corrosion, volume 1. Citations from the engineering index data base
[NTIS/PS-78/0454/5-VOL-1] N78-29230
Pipeline corrosion, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0455/2-VOL-2] N78-29231
ASME report on pipeline system safety
[PB-279330/5] N78-29288
PIPES [TUBES]
Some investigations relating to the elastostatics of a tapered tube
[AD-A054330] N78-29508
Vibro-impact responses of a tube with tube-baffle interaction
[ANL-CT-78-11] N78-29510
Effects of geometric nonuniformities on the stresses in piping elbows
[WARD-SD-3045-7] N78-29513
Heat transfer studies from single cylinder and tube bundle in fluidized bed
N78-29964
PITCH [INCLINATION]
Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068
Investigations of the transonic flow around oscillating airfoils
[NLR-TR-77090-U] N78-29074
PLANE WAVES
Plane shock wave studies of geologic media
[UCRL-52357] N78-29687
PLANETARY ATMOSPHERES
A new inversion method for remote sounding of planetary atmospheres --- spectral lines
[NASA-TM-79604] N78-30027
PLANETARY MAPPING
Atlas of Mercury --- Mariner 10 mission
[NASA-SP-423] N78-30025
PLANETARY SURFACES
Atlas of Mercury --- Mariner 10 mission
[NASA-SP-423] N78-30025
PLANKTON
Phytoplankton sampling in quantitative baseline and monitoring programs
[PB-279644/9] N78-29733
PLANTS [BOTANY]
Neutralization of organic substances in waste water by plants
[AD-A053435] N78-29728
PLASMA CONTROL
A general two-dimensional tokamak model
[AD-A054413] N78-29918
PLASMA CYLINDERS
Beam deviation method as a diagnostic tool for the plasma focus
[IPF-78-3] N78-29931
PLASMA DENSITY
Numerical simulation of ionospheric and plasmaspheric dynamics
[AD-A053451] N78-29680
PLASMA DIAGNOSTICS
Laser fusion power balance measurements [particle transmission diagnostics]
[EPRI-ER-591] N78-29444
Second Topical Conference on High-Temperature Plasma Diagnostics
[LA-7160C] N78-29927
PLASMA DYNAMICS
Observations pertaining to the dynamics of the plasma sheet
N78-29908
A general two-dimensional tokamak model
[AD-A054413] N78-29918
PLASMA FREQUENCIES
Microwave absorption studies near the plasma frequency
[LA-UR-78-51] N78-29928
PLASMA HEATING
Lower hybrid wave heating experiments at General Atomic
[GA-A-14810] N78-29920
Limitations on lower hybrid heating of dense, hot plasmas
[GA-A-14783] N78-29923
PLASMA INTERACTIONS
Plasma-laser interactions with solid poly-styrene microspheres
N78-29910
PLASMA JETS
Plasma scattering experiments with a periodic Nd:YAG laser at 1.06 micron and a Si-avalanche detector
[IPF-78-2] N78-29446
PLASMA LAYERS
The RIAR system, a new telecommunication system. High-altitude, artificially-ionised regions. Possible extension to VHF, UHF and SHF telecommunication
[RAE-LIB-TRANS-1968] N78-29311
PLASMA PHYSICS
System analysis of plasma centrifuges and sputtering
[NASA-CR-135079] N78-29916
PLASMA PINCH
Current and neutron yield scaling of fast high voltage plasma focus
[IPF-77-2] N78-29930
Beam deviation method as a diagnostic tool for the plasma focus
[IPF-78-3] N78-29931
PLASMA PROBES
Observations pertaining to the dynamics of the plasma sheet
N78-29908
PLASMA RADIATION
Radiation phenomena of plasma waves. Part 1: Fundamental radiation theory
[IPPJ-336-PT-1] N78-29915
PLASMA RESONANCE
Nonlinear Landau damping in the ionosphere
[NASA-TM-79595] N78-29672
PLASMA SHEATHS
Potential barriers and asymmetric sheaths due to differential charging of nonconducting spacecraft
[AD-A053618] N78-29366
Observations pertaining to the dynamics of the plasma sheet
N78-29908
PLASMA TEMPERATURE
A heating mechanism of ions due to large amplitude coherent ion acoustic wave
[IPPJ-333] N78-29912
PLASMA TURBULENCE
Introduction to the kinetic theory of plasma turbulence
[INPE-1196-PE/112] N78-29917
PLASMA WAVES
Radiation phenomena of plasma waves. Part 1: Fundamental radiation theory
[IPPJ-336-PT-1] N78-29915
PLASMA-ELECTROMAGNETIC INTERACTION
Anomalous ion loss by low frequency instabilities
[IPPJ-334] N78-29913
Effect of lower hybrid waves on the evolution of the Doublet 2A plasma
[GA-A-14809] N78-29921
PLASMA-PARTICLE INTERACTIONS
Plasma scattering experiments with a periodic Nd:YAG laser at 1.06 micron and a Si-avalanche detector
[IPF-78-2] N78-29446
PLASMAPAUSE
Numerical simulation of ionospheric and plasmaspheric dynamics
[AD-A053451] N78-29680
PLASMAS [PHYSICS]
Monte Carlo simulation of the classical two-dimensional one component plasma --- thermodynamic properties and lattice dynamics in the liquid and solid phases
[NASA-CR-157467] N78-29911
Radiation phenomena of plasma waves. Part 1: Fundamental radiation theory
[IPPJ-336-PT-1] N78-29915
The annihilation of galactic positrons
[NASA-TM-79600] N78-30037
PLASTIC DEFORMATION
Processes of plastic deformation, their conditions and effect on the properties of the final product
[LA-TR-77-68] N78-29279
Elastic-plastic crack closure analysis of Dugdale crack plates based on fatigue fracture mechanics
[REPT-30] N78-29489
Rate theory of a two-dimensional elasto-plastic continuum
[TAE-303] N78-29502
In-plane deformation of non-coaxial plastic soil
[AD-A054217] N78-29686
PLASTICS
Penetration of solvents in plastic material
[FOA-C-20201-H2] N78-29258
An experimental technique for vacuum infiltration of cracks with plastic and subsequent study in the scanning electron microscope
[VTH-LR-249] N78-29521
PLATEAUS
Papers presented to the Conference on Plateau Uplift: Mode and Mechanism
[NASA-CR-157468] N78-29663
PLATINUM
Medical and biologic effects of environmental pollutants platinum-group metals
[PB-279464/2] N78-29659
PLOTTERS
General strip chart plotting routine
[AD-A054156] N78-29801
PLUMES
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632
Measurements at cooling tower plumes. Part 3: Three-dimensional measurements at cooling tower plumes
[ANL-TRANS-1117-PT-3] N78-29633
Houston urban plume study: 1974, description and data
[PB-279409/7] N78-29658
POINT DEFECTS
Direct observation of the point-defect structure of depleted-zones in ion-irradiated metals
N78-29213
Relaxation of third order elastic constants in crystals with point defects --- thermodynamics of nonlinear anelastic relaxation
N78-29943
POISSON EQUATION
Some investigations relating to the elastostatics of a tapered tube
[AD-A054330] N78-29508
Fast Poisson solvers on general two dimensional regions for the Dirichlet problem
[AD-A054539] N78-29830
POLARIMETERS
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902
POLARIMETRY
Polarimetry of Be stars at 1.25 and 2.2 microns
N78-30013
POLAROGRAPHY
Some investigations in theoretical and experimental electrochemistry
N78-29170
POLICIES
Analytical studies for the US Environmental Protection Agency. Volume 8. Noise abatement: Policy alternatives for transportation
[PB-279536/7] N78-29641
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982
POLISHING
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902
POLLUTION CONTROL
Desulfurization of coal and petroleum, volume 2. A bibliography with abstracts
[NTIS/PS-78/0497/4] N78-29270
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 2: Technical discussion
[PB-279636/5] N78-29639
US/USSR Symposium on Particulate Control [second]
[PB-279625/8] N78-29644
Evaluation of three industrial particulate scrubbers
[PB-279572/2] N78-29656
POLLUTION MONITORING
Tradescantia stamen hair: An introduction to the system and its use as a monitor atmospheric pollutants
[BNL-23829] N78-29635
Analytical studies for the US Environmental Protection Agency. Volume 4: Environmental monitoring
[PB-279534/2] N78-29640
Evaluation of a technique for sampling low concentrations of organic vapors in ambient air
[PB-279672/0] N78-29652
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657
Phytoplankton sampling in quantitative baseline and monitoring programs
[PB-279644/9] N78-29733

POLYATOMIC MOLECULES
Some investigations in theoretical and experimental electrochemistry N78-29170
POLYBUTADIENE
Study of the ageing effects of styrene copolymers [BLL-PO-TRANS-3502-[7737.47]] N78-29242
POLYETHYLENES
High-pressure X-ray diffractioa study of linear polyethylene N78-29240
Testing the stability of high-density polyethylene --- oxidation resistance, weathering, and durability [BLL-PO-TRANS-3564-[7737.47]] N78-29243
Water vapor permeability of plastic fast packs [AD-A054509] N78-29254
POLYMER CHEMISTRY
Theoretical analysis of solvent effects on polymer conformation --- polypeptides and the hydration shell theory N78-29238
Linear polybenzyl derivatives N78-29239
Interaction of water with hydrophilic methacrylate polymers N78-29244
POLYMERIC FILMS
Solid Polymer Electrolyte [SPE] fuel cell technology program [NASA-CR-151750] N78-29567
POLYMERIZATION
The kinetics of two-phase emulsion polymerization N78-29236
POLYMERS
Chemical reactions and properties of organosilicon compounds related to new materials [AD-A053672] N78-29150
Polymeric replamineform biomaterials and a new membrane structure N78-29241
Synthesis, magnetic susceptibility, and Moessbauer spectra of Fe[III] dimers and Fe[II] polymers containing 2,5-dihydroxy-1,4-benzoquinones [AD-A054678] N78-29250
Entangled polymers: Polystyrene in butanone [SAND-77-1734C] N78-29255
Alternate materials of construction for geothermal applications [BNL-50751] N78-29611
POLYNOMIALS
Adaptive piecewise polynomial L1 approximation [AD-A053651] N78-29822
A set of orthogonal polynomials that generalize the racah coefficients or 6 -J symbols [AD-A054552] N78-29835
POLYPEPTIDES
Theoretical analysis of solvent effects on polymer conformation --- polypeptides and the hydration shell theory N78-29238
POLYSTYRENE
Study of the ageing effects of styrene copolymers [BLL-PO-TRANS-3502-[7737.47]] N78-29242
Entangled polymers: Polystyrene in butanone [SAND-77-1734C] N78-29255
Plasma-laser interactions with solid poly-styrene microspheres N78-29910
POLYURETHANE FOAM
The effect of sample orientation on flame spread across polyurethane foams N78-29181
POLYURETHANE RESINS
Molecular beam sampling mass spectrometry of high heating rate of HMX in a polyurethane binder [AD-A054328] N78-29249
POLYVINYL CHLORIDE
Solubility of hydrogen chloride and the kinetics of degradation of polyvinyl chloride [BLL-PO-TRANS-3558-[7737.47]] N78-29180
PONDS
Aeration of sewage lagoons, reservoirs, and streams. Citations from the engineering index data base [NTIS/PS-78/0434/7] N78-29999
Stabilization ponds: Operations manual [PB-279443/6] N78-30005
POROUS MATERIALS
Measurement of isochoric pressure-energy for porous materials, part 1. Stress-matching technique and reference material results [AD-A054329] N78-29223
High resolution masks for ion milling pores through substrates of biological interest [NASA-CR-135435] N78-29276
Simulation of saturated and unsaturated deformable porous media --- flow distribution and displacement in aquifiers N78-29404
POSITRON ANNIHILATION
The annihilation of galactic positrons [NASA-TM-79600] N78-30037
POSITRONS
High order contributions to the hyperfine structure in positronium and muonium N78-29887
POTENTIAL ENERGY
On the possibility of negative activation energies in bimolecular reactions [NASA-TM-78509] N78-29149
On the maintenance of Walker circulation [INPE-1260-PE/136] N78-29666
POWDER [PARTICLES]
Packing, sintering and blending of binary powder mixtures N78-29207
POWER SERIES
Properties of certain generalized power series distributions N78-29841
POWER SPECTRA
Computation of the irregularity-factor N sub o/N sub 1 of a stationary Gaussian process with dual peak power spectral density [TB-137] N78-29501
PREAMPLIFIERS
Hydrophone preamplifier optimization: Prediction of hydrophone self-noise by a noise model [AD-A053449] N78-29874
PRECESSION
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity --- rotor precession in steam turbines [BLL-CE-TRANS-7083-[9022.09]] N78-29066
PRECIPITATION HARDENING
Dynamic strain aging behavior and its impact on tensile and creep deformation of Ti-5Al-2.5Sn N78-29202
PREDICTION ANALYSIS TECHNIQUES
Noise prediction technology for CTOL aircraft N78-29057
PRESIDENTIAL REPORTS
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978 [PB-279607/6] N78-29971
PRESSURE DISTRIBUTION
Calculation of pressure distribution, forces and moments for the fighter configuration IAe 60 by panel method [DLR-IB-151-77/13] N78-29072
Thermodynamic properties of SeS [LBL-6994] N78-29155
PRESSURE EFFECTS
High-pressure X-ray diffraction study of linear polyethylene N78-29240
PRESSURE GAGES
Proposed design for a differential pressure gage to measure dynamic pressure in blast waves [AD-A054372] N78-29427
PRESSURE PULSES
Hydraulic pressure pulses with elastic and plastic structural flexibility: Test and analysis [LWBR development program] [WAPD-TM-1375] N78-29515
PRESSURE REDUCTION
Analysis of fluid dynamics during rapid depressurization of systems containing high enthalpy water N78-29397
PRESSURE SENSORS
Fluidic pressure ratio sensor [AD-A054464] N78-29109
PRESSURE SUITS
Medical evaluation of 2-pressure suit used in explosive decompressions up to 20.000 m altitude [FOA-A-59002-H3] N78-29761
PRESSURE VESSELS
Low cycle-fatigue and fracture behaviour as parameters for the dimensioning of high pressure vessels [ICAF-1012] N78-29499
PRESTRESSING
Torquing preload in a lubricated bolt [NASA-TM-78501] N78-29451
Computation of tensile stress in prestressed members due to cable restraint during detensioning [PB-279391/7] N78-29526
PRIMERS [COATINGS]
Effectiveness of over-rust primer for Naval shore facilities [AD-A053557] N78-29247
PROBABILITY DISTRIBUTION FUNCTIONS
Studies on clustered files N78-29772
Properties of certain generalized power series distributions N78-29841
PROBABILITY THEORY
The method of maximum likelihood applied to the statistical analysis of fatigue data including run-outs [ICAF-1036] N78-29504
Overview of the economic theory of uncertainty and its implications for energy supply [EPRI-EA-586] N78-29599
Incorporating uncertainty in energy supply models [EPRI-EA-703-VOL-2] N78-29602
Studies on clustered files N78-29772
Toward a theory of probabilistic automata with environments [AD-A053986] N78-29811
PROBLEM SOLVING
A test of a cognitive model of computer program readability --- human problem solving N78-29768
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering --- problem solving methods at the University of Houston [NASA-CR-157364] N78-29820
A finite difference technique for solving optimization problems governed by linear functional differential equations [AD-A053738] N78-29823
Time series in M dimensions: Definition, problems and prospects [AD-A054584] N78-29850
Field manual for performance evaluation and troubleshooting at municipal wastewater treatment facilities [PB-279448/5] N78-30003
PROCESS CONTROL [INDUSTRY]
Dynamic model for computer control of the extrusion of solid dielectric cable [EPRI-EL-605] N78-29381
PRODUCT DEVELOPMENT
Design of space-type electronic power transformers [NASA-CR-134992] N78-29353
PRODUCTION ENGINEERING
Production Engineering Measure [PEM]: Manufacturing methods and technology for piezoelectric transformers [AD-A054177] N78-29371
Manufacturing Methods and Technology Engineering [MM and TE] program for the establishment of production techniques for high density thick film circuits used in crystal oscillators [AD-A054562] N78-29377
PROGRAMMING LANGUAGES
Analyzing the learning of computer programming concepts through the teaching of PAL N78-29787
Succinctness of descriptions of context-free, regular and finite languages N78-29788
An XPL/ALGOL translator [INPE-1304-TPT/096] N78-29793
A comparison of the axiomatic and functional models of structured programming [AD-A053629] N78-29795
PROJECT MANAGEMENT
Solar demonstrations on Federal residences: Better planning and management control needed [PB-279485/7] N78-29624
PROJECT PLANNING
Municipal and industrial water conservation-the Federal government could do more [PB-279487/3] N78-29556
Summary: Workshop on the DOE Combustion Diagnostics Facility [SAND-77-8287] N78-29591
Information service planning and evaluation: A goal programming approach [AD-A054108] N78-29968
Interface milestone management [IM2] concept [PB-279252/1] N78-29970
PROJECTILE CRATERING
A model for thick-target projectile penetration based on instrumented-pressure-bar recording of penetration forces [FOA-B-20016-D4] N78-29463
PROPAGATION VELOCITY
Causality and the propagation of relativistic fields N78-29297
PROPELLANT CHEMISTRY
Development and characterization of analysis methods for control of highly concentrated hydrazine --- rocket propellants [FOA-C-20213-D3] N78-29264
PROPELLER BLADES
Design of impact-resistant boron/aluminum large fan blade [NASA-CR-135417] N78-29104
PROPELLERS
Corrosion fatigue of cast propeller alloys in flowing seawater [PB-279337/0] N78-29234
PROPORTIONAL COUNTERS
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH [NASA-CR-157356] N78-29539
PROPULSION SYSTEM CONFIGURATIONS
Propulsion/flight control integration technology [PROFIT] software system definition [NASA-CR-144876] N78-29102

PROPULSION SYSTEM PERFORMANCE
Quick look test report: MPT static firing no. 2 test MPT-S2
[NASA-CR-151814] N78-29141
PROTECTIVE COATINGS
Effectiveness of over-rust primer for Naval shore facilities
[AD-A053557] N78-29247
High resolution masks for ion milling pores through substrates of biological interest
[NASA-CR-135435] N78-29276
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
PROTON IRRADIATION
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
PROTONS
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889
PROVING
Integrated guidance, navigation and control verification plan primary flight system --- space shuttle avionics integration
[NASA-CR-151815] N78-29144
PUBLIC LAW
Technology transfer and other public policy implications of multi-national arrangements for the production of commercial airframes
[NASA-CR-159890] N78-29045
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007
PULSE AMPLITUDE
An ultrasonic pulse-height difference method of recording crack growth over an extended period
[ARL/MAT-NOTE-120] N78-29495
PULSE COMMUNICATION
DEMOD/decoder integration
[AD-A053685] N78-29319
PULSED LASERS
Pulsed laser-excited fluorescence
N78-29160
On scattering diagnostics with periodically pulsed lasers to follow the continuous evolution of time dependent plasma parameters
[IPF-77-5] N78-29445
PUMPS
Design and testing of a small feedwater pump
[AD-A053646] N78-29453
PYROLYSIS
Thermodynamic properties of SeS
[LBL-6994] N78-29155
Shock tube studies of formaldehyde pyrolysis
[AD-A053695] N78-29185
Metastable diamond synthesis and the rate of carbon formation on diamond
N78-29237
Molecular beam sampling mass spectrometry of high heating rate of HMX in a polyurethane binder
[AD-A054328] N78-29249
Properties of spray pyrolysis CdS film and its application to thin film solar cell
N78-29565
PYROTECHNICS
Investigating mapping techniques for elucidating processes occurring in pyrotechnic flames and their flame analogs
[AD-A053373] N78-29260

Q

Q SWITCHED LASERS
The synthesis of substituted nickel dithiene complexes with intense electronic transitions in the infrared region
[AD-A054675] N78-29439
QUADRATIC PROGRAMMING
Quadratic interpolation is risky
[AD-A054558] N78-29837
QUALITY CONTROL
Procedures to accomplish quality control of meteorological altitude data
[INPE-1037-NTE/089] N78-29700
QUANTITATIVE ANALYSIS
Investigations into the determination of trace levels of iron, Part 1: A field method for the determination of EDTA in natural water
N78-29159
Corrosion fatigue of high strength aircraft structural materials - crystallographic dependence of fracture path in Al-Zn-Mg [7075] alloys
[AD-A053743] N78-29221
QUANTUM THEORY
High order contributions to the hyperfine structure in positronium and muonium
N78-29887
QUENCHING [COOLING]
Heat transfer during transition from film to nucleate boiling of water in force convection upward flow
N78-29398
QUEUEING THEORY
The application of diffusion approximations to the study of time-sharing computers and transitory queueing systems
[AD-A054313] N78-29812

R

RADAR IMAGERY
Image understanding research --- matching, radar imagery, and holograms
[AD-A054091] N78-29329
RADAR SIGNATURES
Radam phenomena of tracked vehicles
[AD-A053634] N78-29315
RADAR TRACKING
Radar-77
[AD-A053624] N78-29314
Tracking and monitoring hurricanes by HF skywave radar over the Gulf of Mexico
[AD-A053638] N78-29702
RADAR TRANSMISSION
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328
RADIATION
A spectroscopic investigation of the hydrogennitric oxide flame
N78-29178
RADIATION DAMAGE
Thermal model of laser-induced skin damage: Computer program operator's manual
[AD-A053416] N78-29738
RADIATION EFFECTS
A study of radiation effects in MOS capacitors
N78-29346
Influence of microwaves within the thermal intensity range in mice. Weight, rectal temperature, respiration, tread mill activity, reaction of senses, and learning
[FOA-C-54018-H2/H6] N78-29730
Biological effects of microwaves. A bibliography with abstracts
[NTIS/PS-78/0432/1] N78-29745
RADIATION PROTECTION
Efforts by the Environmental Protection Agency to protect the public from environmental nonionizing radiation exposures
[PB-279483/2] N78-29746
RADIATION SPECTRA
The annihilation of galactic positrons
[NASA-TM-79600] N78-30037
RADIATION TOLERANCE
The apparent resistance of aerials
[BLL-PO-TRANS-3538-[7737.47]]
N78-29341
RADIATIVE TRANSFER
Kinetic description of interaction of radiation with two- and three-level molecular systems
N78-29883
RADIO FREQUENCY HEATING
Coupling of lower hybrid waves in the doublet 2A high power RF heating experiments
[GA-A-14808] N78-29922
RADIO FREQUENCY INTERFERENCE
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328
RADIO NAVIGATION
Navigation planning--need for a new direction
[PB-278627/5] N78-29080
RADIO RELAY SYSTEMS
TDRSS system configuration study for space shuttle program
[NASA-CR-151751] N78-29140
RADIO SPECTRA
The radio spectrum of coronal hole 1
[AD-A051138] N78-30029
RADIO TELESCOPES
A study of neutral hydrogen in early-type galaxies in the virgo cluster
N78-30020
RADIOACTIVE ISOTOPES
Milk secretion of Zn-65 in the goat after oral intake of radiozinc
[FOA-C-40069-A3] N78-29731
RADIOCHEMISTRY
Radio chemistry as a diagnostic in laser fusion experiments
[UCRL-79778] N78-29442
RADIOMETERS
Tracking station for meteorological satellites with a high resolution radiometer
[INPE-1040-RAE/027] N78-29135
The TIROS-N polar orbiting-environmental satellite system
[PB-280743/6] N78-29139
RAILS
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525
The prediction of aerodynamic and wheel/rail noise generated by high-speed trains
[DLR-IB-257-77/14] N78-29877
RAIN
Derivation of initial soil moisture accounting parameters from soil properties for the National Weather Service River Forecast System
[PB-21070/5] N78-29560
RAIN EROSION
Estimates from satellites of weather erosion parameters for reentry systems
[AD-A053654] N78-29136
RAMAN SPECTRA
Determination of temperature and differential scattering cross-sections from rotational Raman scattering of laser radiation at 488.0 nm
[NPL-QU-43] N78-29447
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
A study of the vibrational spectra of the partially-deuterated polycrystalline ethylenes
N78-29951
RAMAN SPECTROSCOPY
International Conference on Matrix Isolation Spectroscopy [1st]
[AD-A053579] N78-29186
Sample modulated Raman spectroscopy and frequency modulated visible light: Resonance Raman spectrum of a polydiacetylene fiber
[AD-A054674] N78-29187
RAMJET ENGINES
Flame efficiency, stabilization and performance in prevaporizing/premixing combustors
[AD-A053635] N78-29184
Mixing and combustion in high speed air flows --- combustor design
[AD-A054398] N78-29188
RANDOM ACCESS MEMORY
The use of redundant packets in slotted-Aloha-type radcom-access systems
[AD-A053737] N78-29318
RANDOM PROCESSES
Computation of the irregularity-factor N sub o/N sub 1 of a stationary Gaussian process with dual peak power spectral density
[TB-137] N78-29501
RANDOM VARIABLES
Toward a theory of probabilistic automata with environments
[AD-A053986] N78-29811
RAPID TRANSIT SYSTEMS
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006
RATIOS
Fluidic pressure ratio sensor
[AD-A054464] N78-29109
RAY TRACING
A low-frequency limitation of FACT
[AD-A054371] N78-29875
Beam deviation method as a diagnostic tool for the plasma focus
[IPF-78-3] N78-29931
RDX
Determination of RDX in UC-36 --- explosives colorimetry
[FOA-C-20216-D1] N78-29265
REACTION CONTROL
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142
REACTION KINETICS
On the possibility of negative activation energies in bimolecular reactions
[NASA-TM-78509] N78-29149
Experimental studies of interfacial electro chemistry
N78-29158
Solubility of hydrogen chloride and the kinetics of degradation of polyvinyl chloride
[BLL-PO-TRANS-3558-[7737.47]]
N78-29180
The kinetics of two-phase emulsion polymerization
N78-29236
Measurements of selected charge transfer processes at low energies
[AD-A054360] N78-29683
Laboratory measurements of selected D-region reactions
[AD-A054361] N78-29685
Collisional stabilization of chemically activated molecules --- cyclic hydrocarbons
N78-29891
Numerical simulation and optimization of chemical processes-application to solid waste gasification --- optimizing a fluidized bed processor
N78-29990

REACTIVITY
Theoretical and experimental studies of reactivity and bonding of transition-metal organometallic compounds
N78-29201
REACTOR TECHNOLOGY
GAC-ANL TNS scoping studies. Volume 11: TNS doublet Tokamak ohmic-heating power supply study -- - Tokamak reactor technology
[GA-A-14614-VOL-11] N78-29919
READING
A test of a cognitive model of computer program readability --- human problem solving
N78-29768
READOUT
Magneto-optic detection system with noise cancellation
[NASA-CASE-NPO-11954-1] N78-29421
REAL TIME OPERATION
Concepts in real-time video tracking
[AD-A054475] N78-29320
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] N78-29545
RECLAMATION
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007
REDUCED GRAVITY
Liquid propellant reorientation in a low-gravity environment
[NASA-TM-78969] N78-29407
Mathematical and computational studies of equilibrium capillary free surfaces
[NASA-CR-135345] N78-29408
REDUCTION [CHEMISTRY]
Liquid metals as process solvents: Design techniques for magnesium oxide reduction
N78-29199
REENTRY VEHICLES
Summary of field support for SAMS VI and MSV operations
[AD-A054343] N78-29128
Estimates from satellites of weather erosion parameters for reentry systems
[AD-A053654] N78-29136
REFRACTORY MATERIALS
Substitution of ceramics for high temperature alloys --- advantages of using silicon carbides and silicon nitrides in gas turbine engines
[NASA-TM-78931] N78-29246
Alternate materials of construction for geothermal applications
[BNL-50751] N78-29611
REFRIGERATING
Thermal energy storage demonstration unit for Vuilleumier cryogenic cooler
[AD-A054466] N78-29589
REGENERATION [ENGINEERING]
Linear accelerator driven [LADR] and regenerative reactors [LARR] for nuclear non-proliferation
[BNL-50731] N78-29898
REGGE POLES
Critical behavior of Reggeon field theory on a lattice --- using Hamiltonian formalism
N78-29944
REGIONAL PLANNING
Airport development: Social and economic effects. A bibliography with abstracts
[NTIS/PS-78/0447/9] N78-29114
Solar energy applications centers: A strategy to facilitate the commercialization of solar energy in New England
[HCP/M4007-01] N78-29592
Energy conservation policy evaluation. Study module 1A, volume 2: Technical appendix
[PB-279664/7] N78-29620
Integrating policy analysis
[PB-279217/4] N78-29621
A methodology to regional planning
[INPE-1263-TPT/087] N78-29967
REGRESSION ANALYSIS
Phi sub p-optimal second order designs for symmetric regions
[AD-A053932] N78-29825
Studies in the analysis of serially dependent data
[AD-A054556] N78-29838
An inverse regression method for determining an ensemble of state error vectors from a covariance matrix
[AD-A054214] N78-29845
Time series in M dimensions: Autoregressive models
[AD-A054586] N78-29851
REGRESSION COEFFICIENTS
A new approach to ARMA modeling
N78-29814
Properties of ordinary and weighted least squares estimators of regression coefficients for two-stage samples
N78-29842
REINFORCED PLATES
Finite element analysis of air pulse wave loaded single thrown concrete plates
[FOA-C-20204-D4[A3]] N78-29516
REINFORCEMENT [STRUCTURES]
Reinforced elastomers and friction supports: Modern methods of antiseismic support
[SAND-78-6001] N78-29257
REINFORCING FIBERS
High performance composites and adhesives for V/STOL aircraft
[AD-A054637] N78-29154
Kevlar 49-epoxy insulator
[SAND-77-0500] N78-29256
RELATIVISTIC EFFECTS
Causality and the propagation of relativistic fields
N78-29297
RELATIVISTIC VELOCITY
Causality and the propagation of relativistic fields
N78-29297
RELAXATION [MECHANICS]
Oxygen and nitrogen diffusion in group V transition metals
N78-29205
Hydrodynamic theories of relaxation in liquids
N78-29393
RELIABILITY
IRAS on-board software
[NLR-MP-77037-U] N78-29138
Storage reliability of missile materiel program, gyroscope analysis
[AD-A053411] N78-29476
RELIABILITY ANALYSIS
Preliminary study of the reliability of imaging charge coupled devices
[NASA-CR-150761] N78-29352
Accelerated reliability tests on electronic components and equipment
[BLL-PO-TRANS-3557-[7737.47]]
N78-29469
Reliability: Mathematical techniques, volume 1. A bibliography with abstracts
[NTIS/PS-78/0438/8] N78-29486
Reliability: Mathematical techniques, volume 2. A bibliography with abstracts
[NTIS/PS-78/0439/6] N78-29487
RELIABILITY ENGINEERING
Storage reliability of missile materiel program, switch analysis
[AD-A053414] N78-29480
REMOTE SENSORS
Space research in the Republic of South Africa: Report to COSPAR --- on solar terrestrial physics and satellite remote sensing
N78-29125
Advanced Multispectral Scanner [AMS] study --- aircraft remote sensing
[NASA-CR-151753] N78-29424
Remote sensing of the earth's atmosphere by the use of radiation from ozone, oxygen and water vapor
N78-29530
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537
Project geological map to the millionth scale
[INPE-1074-NTE/100] N78-29540
Introduction to a multispectral data analysis system
[INPE-1227-NTE/115] N78-29541
A spectral method for determining the percentage of live herbage material in clipped samples
[NASA-TM-78019] N78-29544
The coverage behavior of ERDSAT for some selected regions of the world
[DLR-IB-552-78/1] N78-29548
RESEARCH AND DEVELOPMENT
A method for the analysis of the benefits and costs for aeronautical research and technology
N78-29060
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082
Research and development in the Environmental Protection Agency, volume 3
[PB-279370/1] N78-29653
RESEARCH FACILITIES
Summary: Workshop on the DOE Combustion Diagnostics Facility
[SAND-77-8287] N78-29591
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978
[PB-279607/6] N78-29971
RESEARCH MANAGEMENT
A review of selected activities in the Office of Telecommunication, Department of Commerce
[PB-279251/3] N78-29336
Analytical studies for the US Environmental Protection Agency. Volume 4: Environmental monitoring
[PB-279534/2] N78-29640
Research and development in the Environmental Protection Agency, volume 3
[PB-279370/1] N78-29653
Report of the science applications task force to the director of the National Science Foundation
[PB-279458/4] N78-29972
RESEARCH PROJECTS
Canada report to COSPAR --- university research and space programs in Canada
N78-29126
California Water Resources Center
[PB-279614/2] N78-29555
RESIDUAL STRESS
Swelling of composite laminates
[AD-A053742] N78-29152
Predicted effects of residual stresses on butt weld fatigue life
N78-29494
RESONANCE CHARGE EXCHANGE
Calculation of electron binding energies --- ionization energies for water and neon and electron affinity of lithium hydride
N78-29882
RESOURCES MANAGEMENT
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information --- organizations and information sources for technology utilization in developing countries
[PB-279193/7] N78-29981
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007
RESPIRATORS
Respirator studies for the Nuclear Regulatory Commission. Protection Factors for supplied-air respirators
[LA-7098-PR] N78-29760
REVISIONS
Modifications to the accuracy assessment analysis routine MLTCRP to produce an output file
[NASA-CR-151811] N78-29794
REYNOLDS NUMBER
Investigation on a slow running centrifugal pump at different Reynolds numbers
[BLL-RTS-10585] N78-29402
RHEOLOGY
The role of temperature in EHD
[AD-A054320] N78-29454
RIDING QUALITY
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
RIGID ROTORS
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044
RIMS
Composite-rim flywheel design
[SAND-77-1061C] N78-29606
RIVER BASINS
Western gas sands project
[NVO/0655-100] N78-29597
RIVERS
Ice on rivers and lakes: A bibliographic essay
[PB-279528/4] N78-29693
ROADS
Computer simulation of the effect of road roughness on tire-pavement forces in braking and cornering
[PB-279887/4] N78-29466
ROBOTS
Computer science and technology: NBS/RIA Robotics Research Workshop proceedings
[PB-279334/7] N78-29290
Analytic method for dimensioning absolute stable control systems --- applied to air robots
[FOA-C-20187-E4] N78-29813
ROCKET ENGINES
Engineering model 8-cm thruster subsystem
[NASA-CR-135406] N78-29147
ROCKET PROPELLANTS
Proceedings of the Conference on Environmental Chemistry of Hydrazine Fuels
[AD-A054194] N78-29261
Development and characterization of analysis methods for control of highly concentrated hydrazine -- - rocket propellants
[FOA-C-20213-D3] N78-29264
ROCKET-BORNE INSTRUMENTS
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH
[NASA-CR-157356] N78-29539
ROCKS
Estimate of earth media shear strength at the Nevada Test Site
[UCRL-52358] N78-29688
ROLL
Evaluation of rollover procedures: 45 Degree dolly rollovers
[PB-279392/5] N78-29468

ROLLER BEARINGS
The role of temperature in EHD
[AD-A054320] N78-29454
Tapered roller bearing development for aircraft turbine engines
[AD-A054045] N78-29458
ROLLING CONTACT LOADS
The role of temperature in EHD
[AD-A054320] N78-29454
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525
ROTARY STABILITY
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity --- rotor precession in steam turbines
[BLL-CE-TRANS-7083-[9022.09]] N78-29066
ROTARY WING AIRCRAFT
Aircraft military utility and functional tests
[AD-A053617] N78-29091
ROTARY WINGS
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044
Heavy lift helicopter - advanced technology component program - rotor blade
[AD-A053423] N78-29089
ROTATING CYLINDERS
Fluid motion between two cylinders rotating at different speeds N78-29394
ROTATING MIRRORS
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132
ROTOR BLADES
Turbine engine rotor dynamic evaluation. Volume 2: Engine and test rig balancing
[AD-A054533] N78-29108
ROTOR BLADES [TURBOMACHINERY]
An investigation of rotor noise generation by aerodynamic disturbance --- aeroacoustic transfer functions
[NASA-CR-157571] N78-29870
ROTORS
Finite element analysis of rotor-bearing systems with matrix reduction N78-29492
An investigation of rotor noise generation by aerodynamic disturbance --- aeroacoustic transfer functions
[NASA-CR-157571] N78-29870
ROUTES
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078
ARPANET routing algorithm improvements
[AD-A053450] N78-29796
ROVING VEHICLES
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132
RUNGE-KUTTA METHOD
Runge-Kutta formulas with extended regions of stability N78-29818
The implementation of implicit Runge-Kutta formulae for the solution of initial-value problems
[NPL-NAC-87] N78-29839
RUNWAYS
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
Nansen-Drift Station Project: Remote sea-ice runway construction
[AD-A054720] N78-29113
Ground winds for Kennedy Space Center, Florida [1978 version]
[NASA-TM-78181] N78-29698
RURAL AREAS
Water problems in the rural environment: Alternative solutions for water supply and waterwaste disposal
[PB-279775/1] N78-29969

S

SAFETY
ASME report on pipeline system safety
[PB-279330/5] N78-29288
SAFETY DEVICES
Evaluation of rollover procedures: 45 Degree dolly rollovers
[PB-279392/5] N78-29468
SAIL PROJECT
Integrated guidance, navigation and control verification plan primary flight system --- space shuttle avionics integration
[NASA-CR-151815] N78-29144
SAILS
Laser driven light sails: An examination of the possibilities for interstellar probes and other missions
[NASA-CR-157362] N78-29117
SALINITY
Coastal upwelling ecosystems analysis. Vertical sections of temperature, salinity and sigma-T. JOINT-II-R/V Thomas G. Thompson Cruise 108 Leg 1
[PB-279174/7] N78-29719
Seasonal description of winds and surface and bottom salinities and temperatures in the northern Gulf of Mexico
[PB-280748/5] N78-29720
SALTS
Determination of particle size distribution of salt crystals in aqueous slurries
[RHO-SA-5] N78-29192
SAN ANDREAS FAULT
Regional variations in upper mantle compressional velocities beneath southern California 1. Post-shock temperatures: Their experimental determination, calculation, and implications, 2. N78-29675
SANDS
Western gas sands project
[NVO/0655-100] N78-29597
Stability properties of a nonlinear differential system in applied mathematics
[CTH-MATH-1977-15] N78-29865
SAS
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH
[NASA-CR-157356] N78-29539
SATELLITE ATTITUDE CONTROL
IRAS on-board software
[NLR-MP-77037-U] N78-29138
SATELLITE CONFIGURATIONS
TDRSS system configuration study for space shuttle program
[NASA-CR-151751] N78-29140
SATELLITE OBSERVATION
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 1: Representative payload definition
[NASA-CR-145348-VOL-1] N78-29119
Space research in the Republic of South Africa: Report to COSPAR --- on solar terrestrial physics and satellite remote sensing N78-29125
The use of satellite imagery for lake classification in Wisconsin
[PB-279628/2] N78-29558
Crop forecasting by satellite: Progress and problems
[PB-279437/8] N78-29561
Spring program '76. Section 1: Meteorological summary. Section 2: Doppler radar data quality control summary
[PB-280745/1] N78-29714
Solar-geophysical data No. 402, February 1978. Supplement: Explanation of data reports
[PB-280733/7] N78-30033
SATELLITE ORBITS
The GEOS-3 orbit determination investigation
[NASA-CR-141441] N78-29127
Analytic theory of orbit contraction
[NASA-CR-157359] N78-30022
SATELLITE SOLAR POWER STATIONS
Solar power satellite system definition study. Part 3: Preferred concept system definition
[NASA-CR-151746] N78-29133
Satellite Power System [SPS] concept development and evaluation program plan, July 1977 - August 1980
[NASA-TM-79400] N78-29593
Study of effects of space power satellites on life support functions of the earth's magnetosphere
[NASA-CR-156948] N78-29674
SATELLITE TEMPERATURE
Theory and design of conventional heat pipes for space applications
[NLR-TR-77001-U] N78-29420
SATELLITE TRACKING
The optimization of self-phased arrays for diurnal motion tracking of synchronous satellites
[NASA-CR-156795] N78-29134
SATELLITE TRANSMISSION
Facsimile communication and electronic mail system by satellite in Iran and other developing nations N78-29301
SATELLITE-BORNE PHOTOGRAPHY
LANDSAT 2 world standard catalog, 1 Jan. - 30 Apr. 1978
[NASA-TM-79740] N78-29538
SATURN RINGS
Light scattering from Saturn's rings calculated by a Markov chain formalism N78-30024
SCALE MODELS
Singular perturbations, order reduction, and decoupling of large scale systems
[AD-A054483] N78-29829
SCALING LAWS
Current and neutron yield scaling of fast high voltage plasma focus
[IPF-77-2] N78-29930
SCANNERS
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132
SCATTERING AMPLITUDE
Gain degradation and amplitude scintillation due to tropospheric turbulence
[NASA-CR-156796] N78-29668
SCATTERING CROSS SECTIONS
Determination of temperature and differential scattering cross-sections from rotational Raman scattering of laser radiation at 488.0 nm
[NPL-QU-43] N78-29447
SCATTEROMETERS
Measurement of soil moisture trends with airborne scatterometers
[E78-10176] N78-29532
SCHOTTKY DIODES
Part 1: A recirculating charge-coupled device. Part 2: The mercury selenide on N-silicon Schottky barrier N78-29933
SCIENTISTS
Report of the science applications task force to the director of the National Science Foundation
[PB-279458/4] N78-29972
SCINTILLATION
Amplitude scintillations on earth-space propagation paths at 2 and 30 GHz
[NASA-CR-156785] N78-29307
SCRUBBERS
Evaluation of three industrial particulate scrubbers
[PB-279572/2] N78-29656
SEA GRASSES
Seagrass literature survey
[AD-A054480] N78-29729
SEA ICE
Nansen-Drift Station Project: Remote sea-ice runway construction
[AD-A054720] N78-29113
SEA WATER
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197
Corrosion fatigue of cast propeller alloys in flowing seawater
[PB-279337/0] N78-29234
Variability of water temperature in the Atlantic near the equator --- GARP Atlantic Tropical Experiment
[BLLD-M-24959-[5828.4F]] N78-29717
Data from the Atlantic Oceanographic and Meteorological Laboratories loop current monitoring cruises May 1975 through August 1976
[PB-280772/5] N78-29721
SEALS [STOPPERS]
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity --- rotor precession in steam turbines
[BLL-CE-TRANS-7083-[9022.09]] N78-29066
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215
SEASAT SATELLITES
Atmospheric prediction model survey
[NASA-CR-157217] N78-29697
SECRETIONS
Milk secretion of Zn-65 in the goat after oral intake of radiozinc
[FOA-C-40069-A3] N78-29731
SEDIMENT TRANSPORT
Sediment and water quality: A review of the literature including a suggested approach for water quality criteria with summary of workshop and conclusions and recommendations
[PB-279469/1] N78-29646
SEDIMENTS
Aquatic disposal field investigations, Eatons Neck disposal site, Long Island Sound. Appendix B: Water-quality parameters and physicochemical sediment parameters
[AD-A053427] N78-29630
SEISMIC WAVES
Reinforced elastomers and friction supports: Modern methods of antiseismic support
[SAND-78-6001] N78-29257
A local earthquake coda magnitude and its relation to duration, moment M sub O, and local Richter magnitude M sub L
[NASA-CR-157473] N78-29664

Trends and Opportunities in Seismology
[PB-279320/6] N78-29694
SEISMOGRAPHS
A differential input gainranging amplifier employing monolithic integrated circuits
[FOA-C-20221-E4] N78-29383
Application of normal mode theory to seismic source and structure problems: Seismic investigations of upper mantle lateral heterogeneity
[NASA-CR-157354] N78-29673
SEISMOLOGY
Regional variations in upper mantle compressional velocities beneath southern California 1. Post-shock temperatures: Their experimental determination, calculation, and implications, 2.
N78-29675
Multivariate linear functional relationships: Estimation of parameters and discrimination between two relationships, with a seismological application
[FOA-B-20015-T1] N78-29690
Trends and Opportunities in Seismology
[PB-279320/6] N78-29694
SELECTION RULES [NUCLEAR PHYSICS]
Selection rule effects in electronic excitations of chemisorbed molecules as studied by energy loss spectroscopy
[AD-A054105] N78-29894
SELECTIVE DISSEMINATION OF INFORMATION
Providing computer-based information services to an academic community
[PB-278330/6] N78-29975
SELENIDES
Part 1: A recirculating charge-coupled device. Part 2: The mercury selenide on N-silicon Schottky barrier
N78-29933
SELENIUM COMPOUNDS
Thermodynamic properties of SeS
[LBL-6994] N78-29155
SEMICONDUCTOR DEVICES
The anomalous voltage response of the P[+]N[-]N[+] device and its effects on second breakdown
[AD-A053539] N78-29359
Time-domain two-dimensional computer simulation of three-terminal semiconductor devices
[AD-A054287] N78-29800
SEMICONDUCTORS [MATERIALS]
Preliminary study of the reliability of imaging charge coupled devices
[NASA-CR-150761] N78-29352
Electrical properties of Pb0.8Sn0.2Te spitaxial films
[AD-A053456] N78-29361
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
Improved semiconductors for photovoltaic solar cells
[DSE/2457-4] N78-29595
Improved semiconductors for photovoltaic solar cells
[DSE/2457-5] N78-29759
SENSITIVITY
Large change sensitivity figure and new algorithm for its minimization
[R-9-77] N78-29856
A phase insensitive ultrasonic transducer --- annealing cadmium sulfide crystals
[NASA-CASE-LAR-12304-1] N78-29871
SEPARATORS
SPAR project: Counter current distribution of biologicals
[NASA-CR-150766] N78-29182
Electrophoretic separator for purifying biologicals, part 1
[NASA-CR-150768] N78-29183
SEQUENCING
Confidence limits on MTBF for sequential test plans of MIL-STD 781
[AD-A054588] N78-29482
SEQUENTIAL CONTROL
The time-sequenced adaptive filter
N78-29343
SET THEORY
The application of convex regularization to Tchebycheff systems
N78-29859
Regular transformation groups and homomorphisms
N78-29860
Approximation of convex set-valued functions
[AD-A054541] N78-29861
SEWAGE
Water problems in the rural environment: Alternative solutions for water supply and waterwaste disposal
[PB-279775/1] N78-29969
Aeration of sewage lagoons, reservoirs, and streams. Citations from the engineering index data base
[NTIS/PS-78/0434/7] N78-29999
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
SEWAGE TREATMENT
Operations manual: Sludge handling and conditioning
[PB-279449/3] N78-30002
Field manual for performance evaluation and troubleshooting at municipal wastewater treatment facilities
[PB-279448/5] N78-30003
Package treatment plants: Operations manual
[PB-279444/4] N78-30004
Stabilization ponds: Operations manual
[PB-279443/6] N78-30005
SHAFTS [MACHINE ELEMENTS]
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components --- roving vehicle electromechanical devices
[NASA-CR-157466] N78-29132
SHALE OIL
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the NTIS data base
[NTIS/PS-78/0423/0] N78-29551
Oil shale mining, processing, uses, and environmental impacts, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0424/8] N78-29552
SHALLOW WATER
Study of shoaling waves in the laboratory
N78-29716
SHARPNESS
Method of forming a sharp edge on an optical device --- beam splitters for Solar Maximum Missions spectrapolarimeter
[NASA-CASE-GSC-12348-1] N78-29902
SHEAR FLOW
The response of turbulent shear flows to discontinuous changes in surface roughness
[ARL/MECH-ENG-REPT-150] N78-29403
SHEAR LAYERS
The response of turbulent shear flows to discontinuous changes in surface roughness
[ARL/MECH-ENG-REPT-150] N78-29403
SHEAR STRENGTH
Estimate of earth media shear strength at the Nevada Test Site
[UCRL-52358] N78-29688
SHELL THEORY
Theoretical analysis of solvent effects on polymer conformation --- polypeptides and the hydration shell theory
N78-29238
Nonlinear deformations and static buckling
[ESA-TT-478] N78-29524
Calculations of atomic inner-shell vacancy yields and their dependence on collision parameters
N78-29886
SHELTERS
Diagnostic tests determining the thermal response of a house
[LBL-6856] N78-29607
SHIPS
The applicability of infrared thermography in the detection of delamination in bridge decks
[PB-279508/6] N78-29285
Biodegradation of shipboard wastewater in collection, holding, and transfer tanks
[AD-A053643] N78-29726
SHOCK [PHYSIOLOGY]
The importance of the Myocardial Depressant Factor [MDF] for the occurrence of irreversible shock. A literature study
[MBL-1977-5] N78-29743
SHOCK WAVES
Numerical solutions of the unsteady transonic small-disturbance equations
[AD-A054036] N78-29071
Electrical response of a bimetallic junction to shock compression
[AD-A053693] N78-29362
Proposed design for a differential pressure gage to measure dynamic pressure in blast waves
[AD-A054372] N78-29427
Shock induced structural response
[AD-A053877] N78-29507
Finite element analysis of air pulse wave loaded single thrown concrete plates
[FOA-C-20204-D4[A3]] N78-29516
Plane shock wave studies of geologic media
[UCRL-52357] N78-29687
SHORT HAUL AIRCRAFT
Short-haul CTOL aircraft research --- on reduced energy for commercial air transportation
N78-29061
Proceedings of the Workshop on Engine-Airframe Integration Short-Haul Aircraft
[AD-A053417] N78-29088
SHRINKAGE
Effects of geometric nonuniformities on the stresses in piping elbows
[WARD-SD-3045-7] N78-29513
SIGNAL ANALYZERS
Ghost analyzer for measuring TV ghost waves
[NHK-LABS-NOTE-223] N78-29300
SIGNAL DISTORTION
On calculation of alternating current switching processes and pulse distortion in narrowband systems
[BLL-RTS-10557] N78-29337
SIGNAL FADING
Ultrasonic simulation of MSBLS multipath fading for orbiter landing configuration
[NASA-CR-151752] N78-29302
SIGNAL PROCESSING
Quantitative processing of signal space data to provide transmission line analysis
[AD-A053444] N78-29316
Synthesis of bandpass signals through the minimum number of samples
[R-5-77] N78-29330
The microprocessor INTEL 8080 A and its use as digital filter
[DLR-IB-552-77/22] N78-29779
Interactive Digital Receiver Simulator [IDRS] system user's manual and software documentation
[AD-A053684] N78-29799
Walsh functions. A bibliography with abstracts
[NTIS/PS-78/0508/8] N78-29978
SIGNAL TO NOISE RATIOS
Tradeoff of hardware and signal-to-noise ratio in moving target indicators
[AD-A054727] N78-29322
SIGNAL TRANSMISSION
The influence of transmission system on subjective picture quality
[BLL-PO-TRANS-3541-[7737.47]]
N78-29299
SILANES
Chemical reactions and properties of organosilicon compounds related to new materials
[AD-A053672] N78-29150
SILICON
Damage profiles in silicon and their impact on device reliability
[AD-A053622] N78-29364
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-14] N78-29417
Defect-free epitaxial layers for Si-vidicon targets
[NHK-LABS-NOTE-220] N78-29954
SILICON CARBIDES
Substitution of ceramics for high temperature alloys --- advantages of using silicon carbides and silicon nitrides in gas turbine engines
[NASA-TM-78931] N78-29246
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-13] N78-29416
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
SILICON NITRIDES
Pressureless sintered beta prime-Si3N4 solid solution: Fabrication, microstructure, and strength
[NASA-TM-78950] N78-29245
Substitution of ceramics for high temperature alloys --- advantages of using silicon carbides and silicon nitrides in gas turbine engines
[NASA-TM-78931] N78-29246
High temperature mechanical properties of polyphase ceramics based on silicon nitride
[AD-A054342] N78-29248
Methods of fabricating ceramic materials
[AD-A054043] N78-29252
SIMULATION
Procedures for functional partitioning and simulation of large digital systems
N78-29347
SIMULATORS
Laser Doppler velocity simulator
[NASA-CASE-LAR-12176-1] N78-29435
Interactive Digital Receiver Simulator [IDRS] system user's manual and software documentation
[AD-A053684] N78-29799
SINGLE CRYSTALS
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals --- l-alanine, triglycine sulfate, and 3-hydroxyanthine
N78-29935
Solid state formation of Nd:Y sub 3 Al sub 5 O sub 12 Nd YAG
[AD-A054428] N78-29959
SINTERING
Structural evolution and electrical conductivity of sintered uranium dioxide
N78-29206
Packing, sintering and blending of binary powder mixtures
N78-29207
Pressureless sintered beta prime-Si3N4 solid solution: Fabrication, microstructure, and strength
[NASA-TM-78950] N78-29245
SKIDDING
Skid resistance study
[PB-279588/8] N78-29464
SKIN [ANATOMY]
Thermal model of laser-induced skin damage: Computer program operator's manual
[AD-A053416] N78-29738

Topical hazard evaluation program of candidate insect repellent AI3-36331, US Department of Agriculture propriety compound
[AD-A054216] N78-29741

SKYNET SATELLITES
Skynet SGEMP test program: The skynet satellite as test object
[AD-A054359] N78-29321

SLAGS
Slagging MHD generator: A parametric study
[SAND-77-1951] N78-29608

SLENDER BODIES
An exact velocity potential solution of steady, compressible flow over arbitrary two-dimensional and axisymmetric bodies in simply connected fields
[AD-A054462] N78-29415

SLUDGE
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001

SLURRIES
Determination of particle size distribution of salt crystals in aqueous slurries
[RHO-SA-5] N78-29192

SMOKE
Toxicological investigation of zinc and titanium smoke compositions. A literature study
[FOA-C-40072-H2] N78-29744

SNOW
Deicing-chemical rates on open-graded pavements: Studies in Maine, Michigan, Utah, and Vermont
[PB-279224/0] N78-29293

SNOW COVER
Research of microwave scattering properties of snow fields
[NASA-CR-157472] N78-29303

SOAPS
Breadboard wash water renovation system --- using ferric chloride and ion exchange resins to remove soap and dissolved salts
[NASA-CR-151818] N78-29993

SOCIAL FACTORS
Civil helicopter design and operational requirement
[NASA-CR-145377] N78-29083
Airport development: Social and economic effects. A bibliography with abstracts
[NTIS/PS-78/0447/9] N78-29114

SODIUM
Simultaneous observations of the Na 5893A
[INPE-1081-PE/067] N78-29667
Nightglow mediums [5893A] and their correlation with atmospheric sodium concentration
[INPE-1032-PE/057] N78-29677

SODIUM COMPOUNDS
Metabolism of 181W-labeled sodium tungstate in goats
[FOA-C-40070-A3] N78-29732

SOIL MECHANICS
In-plane deformation of non-coaxial plastic soil
[AD-A054217] N78-29686

SOIL MOISTURE
Measurement of soil moisture trends with airborne scatterometers
[E78-10176] N78-29532
HCMM: Soil moisture in relation to geologic structure and lithology, Northern California
[E78-10177] N78-29533
Derivation of initial soil moisture accounting parameters from soil properties for the National Weather Service River Forecast System
[PB-210710/5] N78-29560

SOLAR ACTIVITY
Solar-geophysical data no. 402, February 1978. Part 1: Prompt reports. Data for January 1978 - December 1977
[PB-280731/1] N78-30031
Solar-geophysical data no. 402, February 1978. Part 2: Comprehensive reports. Data for August - July 1977 and miscellanea
[PB-280732/9] N78-30032
Solar-geophysical data No. 402, February 1978. Supplement: Explanation of data reports
[PB-280733/7] N78-30033

SOLAR CELLS
Properties of spray pyrolysis CdS film and its application to thin film solar cell
N78-29565
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
A theoretical analysis of the current-voltage characteristics of solar cells
[NASA-CR-157369] N78-29585
Improved semiconductors for photovoltaic solar cells
[DSE/2457-4] N78-29595
Improved semiconductors for photovoltaic solar cells
[DSE/2457-5] N78-29759
Thin film gallium arsenide solar cells and crystal structure determination by X-ray diffraction
N78-29953

SOLAR COLLECTORS
MSFC assessment of Owens-Illinois SUNPAK collector problems
[NASA-TM-78179] N78-29572
Development, testing, and certification of life sciences engineering solar collector
[NASA-TM-78182] N78-29573
Analysis of Chamberlin flat plate solar collector using National Bureau of Standards test criteria
[AD-A054215] N78-29588
Representative industrial solar energy installation, Northridge Hospital, Northridge, California
[UCRL-13789] N78-29613

SOLAR CORONA
The radio spectrum of coronal hole 1
[AD-A051138] N78-30029

SOLAR COSMIC RAYS
Solar-geophysical data no. 402, February 1978. Part 1: Prompt reports. Data for January 1978 - December 1977
[PB-280731/1] N78-30031
Solar-geophysical data no. 402, February 1978. Part 2: Comprehensive reports. Data for August - July 1977 and miscellanea
[PB-280732/9] N78-30032

SOLAR ENERGY
Installation package for 77-180 SOLARSTAT and 77-1 controller
[NASA-CR-150743] N78-29571
Storage systems for solar thermal power
[NASA-TM-78952] N78-29577
Utilization of solar energy in developing countries: Identifying some potential markets
[NASA-TM-78964] N78-29578
Installation package for integrated programmable electronic controller and hydronic subsystem - solar heating and cooling
[NASA-CR-150747] N78-29580
Solar energy applications centers: A strategy to facilitate the commercialization of solar energy in New England
[HCP/M4007-01] N78-29592
Representative industrial solar energy installation, Northridge Hospital, Northridge, California
[UCRL-13789] N78-29613

SOLAR ENERGY CONVERSION
Solar power satellite system definition study. Part 3: Preferred concept system definition
[NASA-CR-151746] N78-29133
Performance and stability analysis of a photovoltaic power system
[NASA-TM-78880] N78-29566
Satellite Power System [SPS] concept development and evaluation program plan, July 1977 - August 1980
[NASA-TM-79400] N78-29593

SOLAR FLARES
Solar-geophysical data no. 402, February 1978. Part 1: Prompt reports. Data for January 1978 - December 1977
[PB-280731/1] N78-30031
Solar-geophysical data no. 402, February 1978. Part 2: Comprehensive reports. Data for August - July 1977 and miscellanea
[PB-280732/9] N78-30032

SOLAR HEATING
Design and installation package for a solar powered pump
[NASA-CR-150740] N78-29570
Installation package for 77-180 SOLARSTAT and 77-1 controller
[NASA-CR-150743] N78-29571
RS-600 programmable controller: Solar heating and cooling
[NASA-CR-150744] N78-29579
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
Solar demonstrations on Federal residences: Better planning and management control needed
[PB-279485/7] N78-29624

SOLAR PHYSICS
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124
Space research in the Republic of South Africa: Report to COSPAR --- on solar terrestrial physics and satellite remote sensing
N78-29125
Solar terrestrial physics data exchange
[AD-A054101] N78-30030

SOLAR RADIATION
Compilation of scientific results from the satellite OVI-17
[AD-A050483] N78-29137
Solar radiation and its agricultural utilization on the hillsides of northeast Brazil
[INPE-1005-TPT/049] N78-29542

SOLAR RADIO EMISSION
The radio spectrum of coronal hole 1
[AD-A051138] N78-30029

SOLID PHASES
Monte Carlo simulation of the classical two-dimensional one component plasma --- thermodynamic properties and lattice dynamics in the liquid and solid phases
[NASA-CR-157467] N78-29911

SOLID ROCKET PROPELLANTS
Quick look test report: MPT static firing no. 2 test MPT-S2
[NASA-CR-151814] N78-29141

SOLID SOLUTIONS
High temperature irradiation damage in nickel-chromium solid solutions
N78-29203
Pressureless sintered beta prime-Si3N4 solid solution: Fabrication, microstructure, and strength
[NASA-TM-78950] N78-29245
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955

SOLID STATE
The anomalous voltage response of the P[+]N[-]N[+] device and its effects on second breakdown
[AD-A053539] N78-29359

SOLID STATE DEVICES
Electronics engineering research proposals for FY78
[UCID-17711] N78-29379

SOLID WASTES
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the NTIS data base
[NTIS/PS-78/0499/0] N78-29266
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the American Petroleum Waste Institute data base
[NTIS/PS-78/0500/5] N78-29267
Numerical simulation and optimization of chemical processes-application to solid waste gasification --- optimizing a fluidized bed processor
N78-29990
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007

SOLID-SOLID INTERFACES
Propulsion/flight control integration technology [PROFIT] software system definition
[NASA-CR-144876] N78-29102

SOLIDS
Studies of solid-catalyzed systems subject to catalyst deactivation and diffusional limitations
N78-29176

SOLITARY WAVES
Nonlinear order parameter fields. 1: Soliton dynamics. 2: Thermodynamics of a model impure system
N78-29963

SOLUBILITY
Solubility of hydrogen chloride and the kinetics of degradation of polyvinyl chloride
[BLL-PO-TRANS-3558-[7737.47]]
N78-29180
Linear polybenzyl derivatives
N78-29239
Simulation of saturated and unsaturated deformable porous media --- flow distribution and displacement in aquifiers
N78-29404
Sources and characteristics of soluable organic nitrogen in activated-sludge effluents
N78-29991

SOLVENTS
Theoretical analysis of solvent effects on polymer conformation --- polypeptides and the hydration shell theory
N78-29238
Penetration of solvents in plastic material
[FOA-C-20201-H2] N78-29258

SORPTION
Interaction of water with hydrophilic methacrylate polymers
N78-29244

SOUTH AFRICA
Space research in the Republic of South Africa: Report to COSPAR --- on solar terrestrial physics and satellite remote sensing
N78-29125

SOUTHERN CALIFORNIA
The air quality and oil spill implications of Alaskan oil importation into Southern California
N78-29626

SOUTHERN HEMISPHERE
Diagnostic model of extratropical perturbation studies
[INPE-1108-PE/082] N78-29671

SOVIET SPACECRAFT
A critical review of the state of foreign space technology
[NASA-CR-157363] N78-29118

SOYUZ SPACECRAFT
Soyuz 22: New contribution to earth study from space
[NASA-TM-75055] N78-29535

SPACE INDUSTRIALIZATION
A critical review of the state of foreign space technology
[NASA-CR-157363] N78-29118

SPACE PROCESSING
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 4: Executive summary
[NASA-CR-145348-VOL-4] N78-29122
SPACE PROCESSING APPLICATIONS ROCKET
SPAR project: Counter current distribution of biologicals
[NASA-CR-150766] N78-29182
SPACE PROGRAMS
Canada report to COSPAR --- university research and space programs in Canada
N78-29126
SPACE SHUTTLE ORBITERS
TDRSS system configuration study for space shuttle program
[NASA-CR-151751] N78-29140
Quick look test report: MPT static firing no. 2 test MPT-S2
[NASA-CR-151814] N78-29141
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142
Ultrasonic simulation of MSBLS multipath fading for orbiter landing configuration
[NASA-CR-151752] N78-29302
SPACE SHUTTLE PAYLOADS
Concepts and requirements for shuttle/payload orbital operations of the space transportation system
[NASA-CR-151808] N78-29143
SPACE SHUTTLES
Integrated guidance, navigation and control verification plan primary flight system --- space shuttle avionics integration
[NASA-CR-151815] N78-29144
SPACE STATIONS
Space station systems analysis study, program review
[NASA-CR-150764] N78-29116
SPACEBORNE EXPERIMENTS
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
SPACEBORNE PHOTOGRAPHY
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
SPACECRAFT
Experimental investigation of contamination prevention techniques to cryogenic surfaces on board orbiting spacecraft
[NASA-CR-152171] N78-29146
SPACECRAFT CHARGING
Potential barriers and asymmetric sheaths due to differential charging of nonconducting spacecraft
[AD-A053618] N78-29366
SPACECRAFT COMMUNICATION
Amplitude scintillations on earth-space propagation paths at 2 and 30 GHz
[NASA-CR-156785] N78-29307
SPACECRAFT CONTROL
Integrated guidance, navigation and control verification plan primary flight system --- space shuttle avionics integration
[NASA-CR-151815] N78-29144
SPACECRAFT GUIDANCE
Integrated guidance, navigation and control verification plan primary flight system --- space shuttle avionics integration
[NASA-CR-151815] N78-29144
SPACECRAFT PROPULSION
Laser driven light sails: An examination of the possibilities for interstellar probes and other missions
[NASA-CR-157362] N78-29117
SPACECRAFT TRACKING
Office of Space Tracking and Data Systems
[NASA-NEWS-RELEASE-78-129] N78-29115
SPACECRAFT TRAJECTORIES
The construction of thermospheric density correction tables for use in satellite trajectory and lifetime predictions
[AD-A054341] N78-29129
SPACECREWS
Methods for microbiological and immunological studies of space flight crews
[NASA-TM-58185] N78-29725
SPACELAB
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 1: Representative payload definition
[NASA-CR-145348-VOL-1] N78-29119
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 2: Ground Processing requirements
[NASA-CR-145348-VOL-2] N78-29120
Spacelab Level 4 programmatic Implementation Assessment Study. Volume 3: Optimization and programmatics
[NASA-CR-145348-VOL-3] N78-29121
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 4: Executive summary
[NASA-CR-145348-VOL-4] N78-29122
SPAIN
Geomagnetic map of Spain for 1975
N78-29689
SPECTRAL RECONNAISSANCE
Advanced Multispectral Scanner [AMS] study --- aircraft remote sensing
[NASA-CR-151753] N78-29424
SPECTRAL SIGNATURES
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537
SPECTROHELIOGRAPHS
The radio spectrum of coronal hole 1
[AD-A051138] N78-30029
SPECTROMETERS
Dispersive and nondispersive analysis: Comparison of the two techniques used in microanalysis by means of an electron microprobe
[BLL-PO-TRANS-3531-[7737.47]]
N78-29422
A spectral method for determining the percentage of live herbage material in clipped samples
[NASA-TM-78019] N78-29544
SPECTROPHOTOMETRY
Observations and analysis of Fe 2 emission in Seyfert 1 galaxies and QSOs
N78-30015
The chemical composition of galactic and extragalactic H II regions
N78-30019
SPECTRORADIOMETERS
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537
SPECTROSCOPY
Critical evaluation of some atom reservoirs for atomic fluorescence spectroscopy
N78-29165
Selection rule effects in electronic excitations of chemisorbed molecules as studied by energy loss spectroscopy
[AD-A054105] N78-29894
SPECTRUM ANALYSIS
Introduction to a multispectral data analysis system
[INPE-1227-NTE/115] N78-29541
A statistical package for computing time and frequency domain analysis
[NASA-TM-56045] N78-29843
Observations and analysis of Fe 2 emission in Seyfert 1 galaxies and QSOs
N78-30015
Observations of three binary X-ray sources: CYG X-1, CYG X-2, and 4U1813+50 [AM HER]
N78-30016
The radio spectrum of coronal hole 1
[AD-A051138] N78-30029
SPEECH RECOGNITION
Word hypothesization for large-vocabulary speech understanding systems
N78-29789
SPHERES
Soft-sphere model for liquid metals
[UCRL-52352] N78-29225
SPIN DYNAMICS
Critical behavior of Reggeon field theory on a lattice --- using Hamiltonian formalism
N78-29944
SPIN-LATTICE RELAXATION
Interaction of water with hydrophilic methacrylate polymers
N78-29244
Nuclear spin-lattice relaxation in small metallic particles
N78-29937
SPLINE FUNCTIONS
Analysis of evolutionary error in finite element and other methods
[AD-A054551] N78-29828
SPUTTERING
Investigating localized corrosion and sputtering feasibility of amorphous chromium-containing alloys
[AD-A053581] N78-29219
STABILITY
Stability properties of a nonlinear differential system in applied mathematics
[CTH-MATH-1977-15] N78-29865
STABILITY DERIVATIVES
Calculation of pressure distribution, forces and moments for the fighter configuration IAe 60 by panel method
[DLR-IB-151-77/13] N78-29072
STABILITY TESTS
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044
Testing the stability of high-density polyethylene --- oxidation resistance, weathering, and durability
[BLL-PO-TRANS-3564-[7737.47]]
N78-29243
STANDARDS
Calibration and related measurement services of the National Bureau of Standards
[PB-279459/2] N78-29287
STAR DISTRIBUTION
The galactic distribution of carbon monoxide: An out-of-plane survey
N78-30021
STARK EFFECT
Calculation of the laser induced Stark shifts in diatomic molecules
[AD-A053637] N78-29892
STARS
Polarimetry of Be stars at 1.25 and 2.2 microns
N78-30013
STATE VECTORS
An inverse regression method for determining an ensemble of state error vectors from a covariance matrix
[AD-A054214] N78-29845
STATIC ELECTRICITY
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
STATIC STABILITY
Mathematical and computational studies of the stability of axisymmetric annular capillary free surfaces
[NASA-CR-135346] N78-29409
Note on the cryostatic stability of superconducting composites --- long wire concept
[ORNL-TM-5989] N78-29962
STATISTICAL ANALYSIS
The method of maximum likelihood applied to the statistical analysis of fatigue data including run-outs
[ICAF-1036] N78-29504
Wind energy statistics for large arrays of wind turbines, Great Lakes and Pacific Coast regions
[RLO/2439-77/2] N78-29590
Development of a laboratory data system executive summary
[PB-279765/2] N78-29782
STATISTICAL DECISION THEORY
The use of stochastic programming for the solution of some problems in statistics and probability
[AD-A054553] N78-29848
STATISTICAL DISTRIBUTIONS
Properties of certain generalized power series distributions
N78-29841
STDN [NETWORK]
Office of Space Tracking and Data Systems
[NASA-NEWS-RELEASE-78-129] N78-29115
STEAM TURBINES
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity --- rotor precession in steam turbines
[BLL-CE-TRANS-7083-[9022.09]]
N78-29066
STEEL STRUCTURES
The deformation of steel bars in a four-point bending machine, measured by holographic interferometry
[NPL-MOM-27] N78-29517
STEELS
Chemical analysis of steel. A bibliography with abstracts
[NTIS/PS-78/0491/7] N78-29235
A preliminary investigation of the interaction of M-50 steel with a perfluoalkylether fluid and a 1 percent additive-fluid formulation
[AD-A054044] N78-29253
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 1: Main report
[PB-279512/8] N78-29282
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 2: Appendix
[PB-279513/6] N78-29283
Automatic control of weld penetration
[AD-A054026] N78-29456
Fatigue tests on I-beams of steel St 52-3
[FB-91] N78-29497
STELLAR MASS
Infrared studies of two dark clouds
N78-30017
STELLAR RADIATION
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3 --- periodic variations
[NASA-TM-79605] N78-30018
STELLAR SPECTRA
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH
[NASA-CR-157356] N78-29539
STEREOCHEMISTRY
Thin film gallium arsenide solar cells and crystal structure determination by X-ray diffraction
N78-29953
STEREOPHOTOGRAPHY
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] N78-29529
STIFFNESS MATRIX
The implementation of implicit Runge-Kutta formulae for the solution of initial-value problems
[NPL-NAC-87] N78-29839
STIRLING CYCLE
A stirling engine computer model for performance calculations
[NASA-TM-78884] N78-29994

STOCHASTIC PROCESSES
A stochastic model for fatigue and optimum design and maintenance methodologies
N78-29081
Planning in interconnected power systems: An example of two-stage programming under uncertainty
[AD-A054554] N78-29376
Advances in filtering techniques for stochastic systems with uncertain parameters, part I
[AD-A054396] N78-29844
Adaptive minimum mean square error forecast of missile trajectory using stochastic difference equation models
[AD-A054540] N78-29846
A Fubini theorem for iterated stochastic integrals
[AD-A054545] N78-29847
The use of stochastic programming for the solution of some problems in statistics and probability
[AD-A054553] N78-29848
Moving average models: Time series in M-dimensions
[AD-A054585] N78-29849
Time series in M dimensions: Definition, problems and prospects
[AD-A054584] N78-29850
Interrelationships between autoregressive and moving average models - the ARMA model: General considerations in M dimensions
[AD-A054587] N78-29852
STORAGE
Storage reliability of missile materiel program, switch analysis
[AD-A053414] N78-29480
STORAGE STABILITY
Storage reliability of missile materiel program. Storage reliability analysis summary report. Volume 1: Electrical and electronic devices
[AD-A053405] N78-29470
Storage reliability of missile materiel program. Storage reliability summary report. Volume 3: Hydraulic and pneumatic devices
[AD-A053409] N78-29471
Storage reliability of missile materiel program. Storage reliability summary report. Volume 4: Ordnance devices
[AD-A053406] N78-29472
Storage reliability of missile materiel program. Storage reliability summary report. Volume 5: Optical and electro-optical devices
[AD-A053407] N78-29473
Storage reliability of missile materiel program, electronic vacuum tube analysis
[AD-A053402] N78-29474
Storage reliability of missile materiel program. Missile material reliability prediction handbook, parts count prediction
[AD-A053403] N78-29475
Storage reliability of missile materiel program, accelerometer analysis
[AD-A053412] N78-29477
STORMS [METEOROLOGY]
Exploratory Meeting on Atmospheric Electricity and Severe Storms
[NASA-CP-2056] N78-29669
Spring program '76. Section 1: Meteorological summary. Section 2: Doppler radar data quality control summary
[PB-280745/1] N78-29714
Severe storms: Prediction, detection, and warning. A report of the Panel on Shortrange Prediction and the Panel on Severe Storms to the Committee on Atmospheric Sciences Assembly of Mathematical and Physical Sciences.
[PB-279306/5] N78-29715
STRATEGY
Strategies for conducting technology assessments
[PB-279471/7] N78-29973
STRATOSPHERE
BENCHMARK-76: Model computations for disturbed atmospheric conditions II. Results for the stratosphere and mesosphere
[AD-A054325] N78-29684
STRESS [PHYSIOLOGY]
Sediment and water quality: A review of the literature including a suggested approach for water quality criteria with summary of workshop and conclusions and recommendations
[PB-279469/1] N78-29646
STRESS ANALYSIS
Effect of chordwise forces and deformations and deformations due to steady lift on wing flutter
[AD-A053640] N78-29110
Measurement of isochoric pressure-energy for porous materials, part 1. Stress-matching technique and reference material results
[AD-A054329] N78-29223
Determination of bending stresses in a spur gear tooth
[RAE-LIB-TRANS-1923] N78-29452
Elastic-plastic crack closure analysis of Dugdale crack plates based on fatigue fracture mechanics
[REPT-30] N78-29489
Stress analysis of a viscoelastic material in the calendering process
N78-29493
External loadings on nozzles in cylindrical shells
[CRIF-MT-122] N78-29520
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537
STRESS CORROSION
Microscopic study of stress corrosion crack growth in an AlZnMg alloy
[NLR-MP-77004-U] N78-29518
STRESS CORROSION CRACKING
Summary of landing gear initial flaws
[AD-A054048] N78-29095
STRESS RELAXATION
Relaxation of third order elastic constants in crystals with point defects --- thermodynamics of nonlinear anelastic relaxation
N78-29943
STRESS-STRAIN DIAGRAMS
The effects of microstructural features on the response of aluminum alloys to cyclic deformation
[AD-A053649] N78-29220
In-plane deformation of non-coaxial plastic soil
[AD-A054217] N78-29686
STRIP MINING
Estimating environmental damages from surface mining of coal in Appalachia: A case study
[PB-279150/7] N78-29553
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
STRUCTURAL ANALYSIS
Active controls technology to maximize structural efficiency
N78-29053
The NASTRAN programmer's manual [level 16.0]
[NASA-SP-223(03)] N78-29505
The NASTRAN user's manual: Level 16.0 supplement
[NASA-SP-222(03)] N78-29506
Application of normal mode theory to seismic source and structure problems: Seismic investigations of upper mantle lateral heterogeneity
[NASA-CR-157354] N78-29673
STRUCTURAL DESIGN
General aviation airplane structural crashworthiness user's manual. Volume 2: Input-output, techniques and applications
[AD-A054317] N78-29084
General aviation airplane structural crashworthiness user's manual. Volume 3: Related design information
[AD-A054266] N78-29085
Extravehicular activity translation arm [EVATA] study
[NASA-CR-151755] N78-29145
Strength and behavior of anchor bolts embedded near edges of concrete piers
[PB-279376/8] N78-29278
Discrete structural optimization
N78-29490
Structural design for a 10-GWh SMES vacuum vessel
[LA-7110-MS] N78-29514
Energy conservation through building design. Citations from the NTIS data base
[NTIS/PS-78/0444/6] N78-29615
Energy conservation through building design. Citations from the engineering index data base
[NTIS/PS-78/0445/3] N78-29616
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
STRUCTURAL DESIGN CRITERIA
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
Applications of cavitation analysis to design and operation of SPTF-HFL pump loops
[SAN/0700-1] N78-29460
Inducing the development and adoption of socially efficient automotive technology
[PB-279454/3] N78-29465
STRUCTURAL ENGINEERING
Design of space-type electronic power transformers
[NASA-CR-134992] N78-29353
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006
STRUCTURAL FAILURE
Summary of landing gear initial flaws
[AD-A054048] N78-29095
STRUCTURAL STABILITY
Nonlinear deformations and static buckling
[ESA-TT-478] N78-29524
SUBMERGING
Codimension one isometric immersions between Lorentz spaces
N78-29858
SUBROUTINES
Automatic differentiation of computer programs and a posteriori error bounds for two-point boundary value problems
N78-29786
SUBSONIC FLOW
Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068
Investigation of the unsteady airloads on wing-store configurations in subsonic flow
[NLR-MP-77025-U] N78-29073
SUBSTRATES
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946
SUCROSE
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947
SULFATES
Reactions of yttria-stabilized zirconia with oxides and sulfates of various elements
[NASA-TM-78942] N78-29216
Air chemistry measurements in the lower atmosphere made from a small aircraft - data presentation
[AC-42] N78-29692
SULFUR
Evaluation of sulfur-tolerant catalytic processes for producing peak-shaving alcohol fuels
[EPRI-AF-687] N78-29263
SULFUR DIOXIDES
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 2: Technical discussion
[PB-279636/5] N78-29639
SULFUR OXIDES
Air chemistry measurements in the lower atmosphere made from a small aircraft - data presentation
[AC-42] N78-29692
SUPERCONDUCTING MAGNETS
Structural design for a 10-GWh SMES vacuum vessel
[LA-7110-MS] N78-29514
SUPERCONDUCTIVITY
Processes of plastic deformation, their conditions and effect on the properties of the final product
[LA-TR-77-68] N78-29279
SUPERCONDUCTORS
Diffusion welding multifilament superconductive composites
[UCRL-80436] N78-29156
Note on the cryostatic stability of superconducting composites --- long wire concept
[ORNL-TM-5989] N78-29962
SUPERCRITICAL WINGS
Investigations of the transonic flow around oscillating airfoils
[NLR-TR-77090-U] N78-29074
SUPERSONIC COMMERCIAL AIR TRANSPORT
Progress in supersonic cruise aircraft technology
N78-29062
SUPERSONIC CRUISE AIRCRAFT RESEARCH
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-1] N78-29867
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 2 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-2] N78-29868
SUPERSONIC JET FLOW
Flow instability and acoustic radiation measurements of low Reynolds number supersonic jets
N78-29065
SUPPLYING
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011
SUPPORTS
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
SURFACE ACOUSTIC WAVE DEVICES
Microwave oscillators. Citations from the engineering index data base
[NTIS/PS-78/0334/9] N78-29385
Surface acoustic wave scattering from grooves in piezoelectric substrates
N78-29952
SURFACE CRACKS
Repair machining and inspection of cracked components
[NLR-MP-77018-U] N78-29483
SURFACE DIFFUSION
Experimental study of gas absorption into turbulent falling films of low surface tension liquids
N78-29395

SURFACE FINISHING
Hydrodynamic air lubricated compliant surface bearing for an automotive gas turbine engine. 2: Materials and coatings
[NASA-CR-135402] N78-29449
Repair machining and inspection of cracked components
[NLR-MP-77018-U] N78-29483
SURFACE PROPERTIES
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
SURFACE REACTIONS
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936
SURFACE ROUGHNESS
Digital simulation of flexible aircraft response to symmetrical and asymmetrical runway roughness
[AD-A053588] N78-29087
Airfield pavement smoothness requirements --- based on riding quality and aircraft response to runway roughness
[AD-A050921] N78-29111
Computer simulation of the effect of road roughness on tire-pavement forces in braking and cornering
[PB-279887/4] N78-29466
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
SURFACE TEMPERATURE
Seasonal description of winds and surface and bottom salinities and temperatures in the northern Gulf of Mexico
[PB-280748/5] N78-29720
SURFACE WAVES
On the influence of a flexural biasing state on the velocity of piezoelectric surface waves
[AD-A054397] N78-29957
SURVEYS
Shifting the government's automatic data processing requirements to the private sector: Further study and better guidance needed
[PB-279482/4] N78-29783
SWELLING
Swelling of composite laminates
[AD-A053742] N78-29152
SWITCHING CIRCUITS
Modelling, analyses and design of switching converters
[NASA-CR-135174] N78-29351
SWITCHING THEORY
On calculation of alternating current switching processes and pulse distortion in narrowband systems
[BLL-RTS-10557] N78-29337
SYMMETRY
Phi sub p-optimal second order designs for symmetric regions
[AD-A053932] N78-29825
SYNCHRONOUS SATELLITES
The optimization of self-phased arrays for diurnal motion tracking of synchronous satellites
[NASA-CR-156795] N78-29134
SYNOPTIC METEOROLOGY
Diagnostic model of extratropical perturbation studies
[INPE-1108-PE/082] N78-29671
SYNTHESIS
Metastable diamond synthesis and the rate of carbon formation on diamond
N78-29237
SYNTHETIC FUELS
Progress on coal-derived fuels for aviation systems
N78-29063
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the NTIS data base
[NTIS/PS-78/0499/0] N78-29266
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the American Petroleum Waste Institute data base
[NTIS/PS-78/0500/5] N78-29267
Possible future marine fuels
[PB-279257/0] N78-29274
SYSTEM EFFECTIVENESS
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
SYSTEMS ANALYSIS
Space station systems analysis study, program review
[NASA-CR-150764] N78-29116
Basic and practical investigations of automated stopped-flow mixing systems
N78-29172
ASME report on pipeline system safety
[PB-279330/5] N78-29288
Advanced microwave radiometer antenna system study
[NASA-CR-156776] N78-29304
On calculation of alternating current switching processes and pulse distortion in narrowband systems
[BLL-RTS-10557] N78-29337
Modelling the static current-voltage functions of transistors on analogue computers, with reference to the GF 126 transistor as an example
[BLL-RTS-10955] N78-29339
Further results regarding multiprocessor systems
N78-29769
System analysis of plasma centrifuges and sputtering
[NASA-CR-135079] N78-29916
Densities of states and spectral weight functions for disordered systems
N78-29939
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947
The effects of melt-crystal interface temperature rise on the analysis of crystal growth in binary borate glass melts
N78-29948
Simple empirical cost model for aircraft --- fly-away prices for civil and military aircraft
[FOA-C-20205-D8[M4]] N78-29986
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008
SYSTEMS ENGINEERING
The design of an optimum alphanumeric symbol set for cockpit displays
[AD-A053447] N78-29097
Avionics planning guidance: Executive summary
[AD-A054719] N78-29098
Solar power satellite system definition study. Part 3: Preferred concept system definition
[NASA-CR-151746] N78-29133
The design of all-passes, low-passes and band-passes with a constant group delay approximated according to Chebishev
[CSIR-TRANS-1402] N78-29305
Advanced Multispectral Scanner [AMS] study --- aircraft remote sensing
[NASA-CR-151753] N78-29424
Man-machine interface analysis of the flight design system
[NASA-CR-151812] N78-29754
Further results regarding multiprocessor systems
N78-29769
Optimization techniques in designing relational database systems
N78-29770
Preliminary design of an accident Information Retrieval System [AIRS] --- using microprocessors for data storage in military helicopters
[HSER-7342] N78-29974
Breadboard wash water renovation system --- using ferric chloride and ion exchange resins to remove soap and dissolved salts
[NASA-CR-151818] N78-29993
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006
SYSTEMS STABILITY
Analytic method for dimensioning absolute stable control systems --- applied to air robots
[FOA-C-20187-E4] N78-29813

T

T-37 AIRCRAFT
Alternatives for future undergraduate pilot training
[AD-A053374] N78-29750
TABLES [DATA]
Vapour-liquid equilibrium data for binary systems containing aliphatic amines: Data and recommendations
[NPL-CHEM-79] N78-29193
Solar-geophysical data No. 402, February 1978. Supplement: Explanation of data reports
[PB-280733/7] N78-30033
TAKEOFF
Wake vortex technology
N78-29055
Simulation and analysis of wind shear hazard --- for aircraft landing and takeoff
[NASA-CR-157470] N78-29699
TANKS [COMBAT VEHICLES]
Laser rangefinder/tank thermal sight integration study
[AD-A054622] N78-29438
TAPE RECORDERS
Recording of measuring data on a cassette tape recorder using commercial FM components
[CSIR-TRANS-1401] N78-29425
TARGET RECOGNITION
Comparison between flight test data and data from a theoretical model for the discovery of a ground target from the air
[FOA-C-56010-H9/H6] N78-29751
TARS
Coal tar technology. A bibliography with abstracts
[NTIS/PS-78/0407/3] N78-29271
TASK COMPLEXITY
Pilot workload analysis based upon in-flight physiological measurements and task analysis methods
[NLR-MP-76001-U] N78-29762
TAXONOMY
Seagrass literature survey
[AD-A054480] N78-29729
TDR SATELLITES
TDRSS system configuration study for space shuttle program
[NASA-CR-151751] N78-29140
TEA LASERS
TEA laser emission on the sequence bands of CO2
[AD-A054149] N78-29437
TECHNOLOGICAL FORECASTING
Progress in supersonic cruise aircraft technology
N78-29062
Studies of advanced transport aircraft
N78-29064
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995
TECHNOLOGY ASSESSMENT
Advanced Multispectral Scanner [AMS] study --- aircraft remote sensing
[NASA-CR-151753] N78-29424
Solid Polymer Electrolyte [SPE] fuel cell technology program
[NASA-CR-151750] N78-29567
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135340] N78-29584
Diagnostics assessment for advanced power systems
[SAND-78-8206] N78-29603
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
Environment, technology, and future generations
[PB-279605/0] N78-29645
Trends and Opportunities in Seismology
[PB-279320/6] N78-29694
Pure and applied mathematics in the People's Republic of China
[PB-279509/4] N78-29840
Strategies for conducting technology assessments
[PB-279471/7] N78-29973
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135341] N78-29992
TECHNOLOGY TRANSFER
Technology transfer and other public policy implications of multi-national arrangements for the production of commercial airframes
[NASA-CR-159890] N78-29045
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information --- organizations and information sources for technology utilization in developing countries
[PB-279193/7] N78-29981
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982
TECHNOLOGY UTILIZATION
Detailed application of a technology for the formulation and expression of standards applicable to the American National Standard Building Code requirements for minimum design loads in buildings and other structures [ANSI A58.1-1972]
[PB-279091/3] N78-29289
Inducing the development and adoption of socially efficient automotive technology
[PB-279454/3] N78-29465
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
Report of the science applications task force to the director of the National Science Foundation
[PB-279458/4] N78-29972
Adoption and utilization of urban technology: A decision-making study, analysis and conclusion, part 2
[PB-279541/7] N78-30010
TECTONICS
Papers presented to the Conference on Plateau Uplift: Mode and Mechanism
[NASA-CR-157468] N78-29663
Regional variations in upper mantle compressional velocities beneath southern California 1. Post-shock temperatures: Their experimental determination, calculation, and implications, 2.
N78-29675
TELECOMMUNICATION
Facsimile communication and electronic mail system by satellite in Iran and other developing nations
N78-29301
The RIAR system, a new telecommunication system. High-altitude, artificially-ionised regions.

Possible extension to VHF, UHF and SHF telecommunication
[RAE-LIB-TRANS-1968] N78-29311
Vehicular intercommunications system
[AD-A054021] N78-29327
A review of selected activities in the Office of Telecommunication, Department of Commerce
[PB-279251/3] N78-29336
TELEVISION RECEPTION
Ghost analyzer for measuring TV ghost waves
[NHK-LABS-NOTE-223] N78-29300
TEMPERATURE CONTROL
A temperature controlled water bath for viscosity measurement
[NPL-MOM-24] N78-29281
Theory and design of conventional heat pipes for space applications
[NLR-TR-77001-U] N78-29420
TEMPERATURE DISTRIBUTION
Thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border
[PB-279470/9] N78-29563
TEMPERATURE GRADIENTS
Heating and cooling degree days for Tennessee
[PB-280740/2] N78-29709
Probability of low and high temperatures in Tennessee
[PB-280741/0] N78-29710
Variability of water temperature in the Atlantic near the equator --- GARP Atlantic Tropical Experiment
[BLLD-M-24959-[5828.4F]] N78-29717
TEMPERATURE MEASUREMENT
Determination of temperature and differential scattering cross-sections from rotational Raman scattering of laser radiation at 488.0 nm
[NPL-QU-43] N78-29447
Diagnostic tests determining the thermal response of a house
[LBL-6856] N78-29607
TEMPERATURE PROFILES
Coastal upwelling ecosystems analysis. Vertical sections of temperature, salinity and sigma-T, JOINT-II-R/V Thomas G. Thompson Cruise 108 Leg 1
[PB-279174/7] N78-29719
TEMPERATURE SENSORS
Installation package for 77-180 SOLARSTAT and 77-1 controller
[NASA-CR-150743] N78-29571
TENNESSEE
Heating and cooling degree days for Tennessee
[PB-280740/2] N78-29709
Probability of low and high temperatures in Tennessee
[PB-280741/0] N78-29710
TENSILE PROPERTIES
Non Hookean behavior in the fiber direction of carbon fiber composites and the influence of fiber waviness on the tensile properties
[VTH-LR-251] N78-29157
TENSILE STRENGTH
Non Hookean behavior in the fiber direction of carbon fiber composites and the influence of fiber waviness on the tensile properties
[VTH-LR-251] N78-29157
TENSILE STRESS
Computation of tensile stress in prestressed members due to cable restraint during detensioning
[PB-279391/7] N78-29526
TENSILE TESTS
Behaviour of pierced and cracked plates loaded beyond general yield
[CRIF-MT-119] N78-29519
TERMINAL BALLISTICS
A model for thick-target projectile penetration based on instrumented-pressure-bar recording of penetration forces
[FOA-B-20016-D4] N78-29463
TERMINAL CONFIGURED VEHICLE PROGRAM
Flight experiments to improve terminal area operations
N78-29058
TERMINAL FACILITIES
Flight experiments to improve terminal area operations
N78-29058
TERMINAL GUIDANCE
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906
TERRAIN
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078
Analysis of the dynamics of shifting cultivation in the tropical forests of Northern Thailand using LANDSAT modeling and classification of LANDSAT imagery
[E78-10178] N78-29534
TERRAIN ANALYSIS
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] N78-29545
TEST EQUIPMENT
Powered inertia reel retraction during ejection
[AD-A054157] N78-29077
TEST FACILITIES
Effectiveness of over-rust primer for Naval shore facilities
[AD-A053557] N78-29247
Laser-fusion program at Los Alamos
[LA-UR-77-174] N78-29443
TEXAS
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007
TEXTURES
The computation of immediate texture discrimination
[AD-A053804] N78-29810
THAILAND
Analysis of the dynamics of shifting cultivation in the tropical forests of Northern Thailand using LANDSAT modeling and classification of LANDSAT imagery
[E78-10178] N78-29534
THEOREM PROVING
On a discrete Rodrigues' formula and a second class of orthogonal Hahn polynomials
[CTH-MATH-1977-12] N78-29864
THERAPY
Ultrasonics in medicine. Citations from the NTIS data base
[NTIS/PS-78/0494/1] N78-29879
Ultrasonics in medicine, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0495/8] N78-29880
THERMAL BATTERIES
Lithium-boron alloy anodes for molten salt batteries, I
[AD-A053621] N78-29587
THERMAL BOUNDARY LAYER
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946
THERMAL CONDUCTIVITY
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946
THERMAL CYCLING TESTS
Thermal cycle testing of 7-segment light emitting diodes [LED] displays. [Test Evaluation]
[AD-A054418] N78-29369
THERMAL DEGRADATION
Solubility of hydrogen chloride and the kinetics of degradation of polyvinyl chloride
[BLL-PO-TRANS-3558-[7737.47]]
N78-29180
THERMAL DIFFUSION
Ice crystal growth in a dynamic thermal diffusion chamber
N78-29662
THERMAL ENERGY
CTS TEP thermal anomalies: Heat pipe system performance
[NASA-CR-159413] N78-29410
Thermal energy storage demonstration unit for Vuilleumier cryogenic cooler
[AD-A054466] N78-29589
A heating mechanism of ions due to large amplitude coherant ion acoustic wave
[IPPJ-333] N78-29912
THERMAL INSULATION
Effectiveness of building insulation applications
[AD-A053452] N78-29277
THERMAL MAPPING
Geothermic model for the rise of deeper groundwater along faults in unconsolidated rocks
[NP-22877] N78-29601
THERMAL STABILITY
Linear polybenzyl derivatives
N78-29239
THERMALIZATION [ENERGY ABSORPTION]
The annihilation of galactic positrons
[NASA-TM-79600] N78-30037
THERMOCOUPLES
Electrical response of a bimetallic junction to shock compression
[AD-A053693] N78-29362
THERMODYNAMIC PROPERTIES
Thermodynamic properties of SeS
[LBL-6994] N78-29155
Analysis of fluid dynamics during rapid depressurization of systems containing high enthalpy water
N78-29397
Diagnostic tests determining the thermal response of a house
[LBL-6856] N78-29607
Monte Carlo simulation of the classical two-dimensional one component plasma --- thermodynamic properties and lattice dynamics in the liquid and solid phases
[NASA-CR-157467] N78-29911
Thermal dynamic properties of NiBr2 and NiSO4 from 10 to 1,200 K
[PB-279646/4] N78-29966
A stirling engine computer model for performance calculations
[NASA-TM-78884] N78-29994
THERMODYNAMICS
Irreversible thermodynamic analysis of electrophoretic light scattering experiments
N78-29161
Concentration susceptibility and the phase diagram of He3-He4 mixtures near the tricritical line
N78-29932
Relaxation of third order elastic constants in crystals with point defects --- thermodynamics of nonlinear anelastic relaxation
N78-29943
Nonlinear order parameter fields. 1: Soliton dynamics. 2: Thermodynamics of a model impure system
N78-29963
THERMOLUMINESCENCE
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals --- l-alanine, triglycine sulfate, and 3-hydroxyanthine
N78-29935
THERMOMETERS
The accuracy of aspiration thermometers
[KNMI-WR-78-1] N78-29430
THERMOPHYSICAL PROPERTIES
Infrared radiometer for measuring thermophysical properties of wind tunnel models
[NASA-CR-158898] N78-29426
THERMOSPHERE
The construction of thermospheric density correction tables for use in satellite trajectory and lifetime predictions
[AD-A054341] N78-29129
THERMOSTATS
Installation package for 77-180 SOLARSTAT and 77-1 controller
[NASA-CR-150743] N78-29571
THICK FILMS
Adhesion of gold in ultra-high vacuum
[BLL-PO-TRANS-3555-[7737.47]]
N78-29210
Manufacturing Methods and Technology Engineering [MM and TE] program for the establishment of production techniques for high density thick film circuits used in crystal oscillators
[AD-A054562] N78-29377
The effects of substrate composition on thick film circuit reliability
[AD-A054316] N78-29958
THIN FILMS
Electron microscopy of crystalline and amorphous electrodeposited thin Ni-P films
N78-29208
Thin film corrosion of anodized high-strength aluminum alloys
[AD-A054424] N78-29224
Integrated thin-film transistor display
[AD-A053627] N78-29358
Manufacturing methods and engineering for TFT addressed display
[AD-A054273] N78-29368
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946
Thin film gallium arsenide solar cells and crystal structure determination by X-ray diffraction
N78-29953
THIN WALLED SHELLS
Viscoelastic buckling of shells
[FFA-TN-HU-1911] N78-29523
THREE DIMENSIONAL FLOW
Analysis and numerical solution of three-dimensional viscous internal flow problems
[AD-A053692] N78-29413
THRESHOLD LOGIC
The threshold point model
N78-29855
THRUST CONTROL
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142
TIMBER INVENTORY
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] N78-29529
TIME DEPENDENCE
Analysis of fluid dynamics during rapid depressurization of systems containing high enthalpy water
N78-29397
On scattering diagnostics with periodically pulsed lasers to follow the continuous evolution of time dependent plasma parameters
[IPF-77-5] N78-29445
Self diffusion in cells and tissues
[AD-A053422] N78-29727
The finite element method applied to a class of time-dependent nonlinear partial differential equations
[TN-21] N78-29819
Time series in M dimensions: Definition, problems and prospects
[AD-A054584] N78-29850

TIME LAG
The time-sequenced adaptive filter
N78-29343
TIME RESPONSE
Inelastic bending of beams under time-varying moments: A state variable approach
[COO-2733-15] N78-29511
TIME SERIES ANALYSIS
A multiparameter time domain averaging model of the human operator
[AD-A054676] N78-29758
A new approach to ARMA modeling
N78-29814
A statistical package for computing time and frequency domain analysis
[NASA-TM-56045] N78-29843
Moving average models: Time series in M-dimensions
[AD-A054585] N78-29849
Time series in M dimensions: Definition, problems and prospects
[AD-A054584] N78-29850
Time series in M dimensions: Autoregressive models
[AD-A054586] N78-29851
Interrelationships between autoregressive and moving average models - the ARMA model: General considerations in M dimensions
[AD-A054587] N78-29852
TIME SHARING
The application of diffusion approximations to the study of time-sharing computers and transitory queueing systems
[AD-A054313] N78-29812
TIME SIGNALS
Automatic path delay corrections to GOES [Geostationary Operational Environmental Satellites] satellite time broadcasts
[PB-279335/4] N78-29334
Disseminating standards of time and frequency: Issues in the evaluation of alternatives systems
[PB-279684/5] N78-29866
TIN
Tin plating and tin plate. Citations from the NTIS data base
[NTIS/PS-78/0477/6] N78-29232
Tin plating and tin plate. Citations from the engineering index data base
[NTIS/PS-78/0478/4] N78-29233
Electrical properties of Pb0.8Sn0.2Te spitaxial films
[AD-A053456] N78-29361
TIPS
Behaviour of pierced and cracked plates loaded beyond general yield
[CRIF-MT-119] N78-29519
TIRES
Computer simulation of the effect of road roughness on tire-pavement forces in braking and cornering
[PB-279887/4] N78-29466
TIROS N SATELLITE
The TIROS-N polar orbiting-environmental satellite system
[PB-280743/6] N78-29139
TISSUES [BIOLOGY]
Application of negative chemical ionization mass spectrometry to the analysis of bovine tissue for chlorodibenzo-p-dioxins and related compounds
N78-29171
High resolution ultrasonic scanning of animal and human tissue in-vivo
[ORNL-TM-5934] N78-29742
TITANIUM
Diffusion welding multifilament superconductive composites
[UCRL-80436] N78-29156
Toxicological investigation of zinc and titanium smoke compositions. A literature study
[FOA-C-40072-H2] N78-29744
TITANIUM ALLOYS
Dynamic strain aging behavior and its impact on tensile and creep deformation of Ti-5Al-2.5Sn
N78-29202
Examination of the mechanical properties of products of titanium alloys obtained by an original hot-working technique
[RAE-LIB-TRANS-1969] N78-29218
TITANIUM COMPOUNDS
Electrical properties and structure of BaO-B2O3-SiO2 glass containing titanium ions
N78-29204
TITANIUM OXIDES
The electrical and optical properties of the system TiO[2-x]. The electrical, optical and photoconducting properties of Fe[2-x]Cr[x]Ob [o less than or equal to x less than or equal to 0.047]
[AD-A053858] N78-29961
TOKAMAK DEVICES
On scattering diagnostics with periodically pulsed lasers to follow the continuous evolution of time dependent plasma parameters
[IPF-77-5] N78-29445
The dissipative trapped electron instability in the linear multi-mirror device
N78-29909
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914
A general two-dimensional tokamak model
[AD-A054413] N78-29918
GAC-ANL TNS scoping studies. Volume 11: TNS doublet Tokamak ohmic-heating power supply study -- - Tokamak reactor technology
[GA-A-14614-VOL-11] N78-29919
Structure of magnetic field perturbations during the development of unsteady separation in the Tokamak-6 installation
[ORNL-TR-4528] N78-29924
Ripple bundle divertor for Tokamaks
[ORNL-TM-6220] N78-29926
TOPOGRAPHY
Analysis of the dynamics of shifting cultivation in the tropical forests of Northern Thailand using LANDSAT modeling and classification of LANDSAT imagery
[E78-10178] N78-29534
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
Atlas of Mercury --- Mariner 10 mission
[NASA-SP-423] N78-30025
TOROIDAL PLASMAS
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914
A general two-dimensional tokamak model
[AD-A054413] N78-29918
Current-driven turbulence in plasmas
[REPT-77-106] N78-29929
TORQUE
Torquing preload in a lubricated bolt
[NASA-TM-78501] N78-29451
TORSIONAL STRESS
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503
TOWERS
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632
Measurements at cooling tower plumes. Part 3: Three-dimensional measurements at cooling tower plumes
[ANL-TRANS-1117-PT-3] N78-29633
TOXICITY
Biological effects of mercury pollution. A bibliography with abstracts
[NTIS/PS-78/0496/6] N78-29651
TOXICOLOGY
Toxicological investigation of zinc and titanium smoke compositions. A literature study
[FOA-C-40072-H2] N78-29744
TRACE ELEMENTS
Investigations into the determination of trace levels of iron, Part 1: A field method for the determination of EDTA in natural water
N78-29159
New methods for improving sensitivity in trace analysis
N78-29164
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001
TRACKING [POSITION]
Improving aided track performance during periods of tracker sensor failure by utilizing a target body fixed coordinate system
[AD-A053445] N78-29090
The GEOS-3 orbit determination investigation
[NASA-CR-141441] N78-29127
Concepts in real-time video tracking
[AD-A054475] N78-29320
A multiparameter time domain averaging model of the human operator
[AD-A054676] N78-29758
TRACKING NETWORKS
Improving aided track performance during periods of tracker sensor failure by utilizing a target body fixed coordinate system
[AD-A053445] N78-29090
TRACKING STATIONS
Tracking station for meteorological satellites with a high resolution radiometer
[INPE-1040-RAE/027] N78-29135
TRADESCANTIA
Tradescantia stamen hair: An introduction to the system and its use as a monitor atmospheric pollutants
[BNL-23829] N78-29635
TRAINING AIRCRAFT
Community noise exposure resulting from aircraft operations. Volume 4: Acoustic data on Air Force trainer/fighter aircraft
[AD-A053702] N78-29873
TRAINING SIMULATORS
Simulators in education and training, volume 2. A bibliography with abstracts
[NTIS/PS-78/0378/6] N78-29752
Simulators in education and training volume 3. A bibliography with abstracts
[NTIS/PS-78/0379/4] N78-29753
TRANSDUCERS
Directory of transducer users
[AD-A053564] N78-29367
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906
TRANSFER FUNCTIONS
An investigation of rotor noise generation by aerodynamic disturbance --- aeroacoustic transfer functions
[NASA-CR-157571] N78-29870
TRANSFORMATIONS [MATHEMATICS]
Efficient matrix transposition with limited high speed storage
[FOA-B-30021-E1] N78-29790
The Bohl transformation and oscillation of linear differential systems
N78-29817
Regular transformation groups and homomorphisms
N78-29860
A variational equivalent to diagonal scaling
[AD-A054548] N78-29863
TRANSFORMERS
Design of space-type electronic power transformers
[NASA-CR-134992] N78-29353
Production Engineering Measure [PEM]: Manufacturing methods and technology for piezoelectric transformers
[AD-A054177] N78-29371
TRANSISTORS
Modelling the static current-voltage functions of transistors on analogue computers, with reference to the GF 126 transistor as an example
[BLL-RTS-10955] N78-29339
Integrated thin-film transistor display
[AD-A053627] N78-29358
Manufacturing methods and engineering for TFT addressed display
[AD-A054273] N78-29368
TRANSITION METALS
Theoretical and experimental studies of reactivity and bonding of transition-metal organometallic compounds
N78-29201
Oxygen and nitrogen diffusion in group V transition metals
N78-29205
TRANSLATORS
An XPL/ALGOL translator
[INPE-1304-TPT/096] N78-29793
TRANSMISSION LINES
Quantitative processing of signal space data to provide transmission line analysis
[AD-A053444] N78-29316
Computer aided EMC analysis - a review of available tools
[NLR-TR-77070-U] N78-29331
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 4: Prediction of crosstalk in ribbon cables
[AD-A053548] N78-29355
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 5: Prediction of crosstalk in volving twisted wire pairs
[AD-A053559] N78-29356
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 6: A digital computer program for determining thermal currents induced in a multiconductor transmission line by an incident electromagnetic field
[AD-A053560] N78-29357
Wisconsin test facility ground terminal corrosion study --- inspection of underground electric cables
[AD-A053715] N78-29363
Dipole array on a transmission line
[AD-A054315] N78-29370
TRANSMISSIONS [MACHINE ELEMENTS]
HLH drive system
[AD-A054024] N78-29094
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135340] N78-29584
TRANSONIC FLOW
Numerical solutions of the unsteady transonic small-disturbance equations
[AD-A054036] N78-29071
Investigations of the transonic flow around oscillating airfoils
[NLR-TR-77090-U] N78-29074
Computer program for relaxation solutions of the nonlinear small disturbance equations for transonic flow in an axial compressor blade row
[AD-A053744] N78-29412
TRANSONIC WIND TUNNELS
Wind tunnel investigation of computationally optimized variable camber wing configurations
[NASA-TM-78479] N78-29067

TRANSPORT AIRCRAFT
Technology transfer and other public policy implications of multi-national arrangements for the production of commercial airframes
[NASA-CR-159890] N78-29045
CTOL Transport Technology, 1978 --- conferences
[NASA-CP-2036-PT-2] N78-29046
Advanced aerodynamics and active controls technology
N78-29047
Experimental results of winglets on first, second, and third generation jet transports --- to reduce drag coefficient
N78-29048
Advanced aerodynamics and active controls for a next generation transport
N78-29052
Active controls technology to maximize structural efficiency
N78-29053
Summary of NASA landing-gear research
N78-29056
Noise prediction technology for CTOL aircraft
N78-29057
Short-haul CTOL aircraft research --- on reduced energy for commercial air transportation
N78-29061
Studies of advanced transport aircraft
N78-29064

TRANSPORT PROPERTIES
Some elements of iceberg technology
[AD-A053431] N78-29679

TRANSPORTATION
Concepts and requirements for shuttle/payload orbital operations of the space transportation system
[NASA-CR-151808] N78-29143
Analytical studies for the US Environmental Protection Agency. Volume 8. Noise abatement: Policy alternatives for transportation
[PB-279536/7] N78-29641
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes --- transportating bulk commodities
[AD-A053690] N78-29985
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-2] N78-29996

TRANSVERSE OSCILLATION
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity --- rotor precession in steam turbines
[BLL-CE-TRANS-7083-{9022.09}] N78-29066

TRAVELING WAVE TUBES
Evaluation of the cumulative failure rate of a system: The optimal interval for preventive replacement of traveling wave tubes
[NHK-LABS-NOTE-222] N78-29342
Defense satellite communications system traveling Wave Tube Amplifier life test report. Volume 1: Twenty watt TWTA
[AD-A053739] N78-29360

TREES [MATHEMATICS]
Decision rules and decision tree approach in pattern recognition theory
N78-29809

TROPICAL METEOROLOGY
Diagnostic model of extratropical perturbation studies
[INPE-1108-PE/082] N78-29671
Tropical wave dynamics
[AD-A054302] N78-29706

TROPICAL REGIONS
Analysis of the dynamics of shifting cultivation in the tropical forests of Northern Thailand using LANDSAT modeling and classification of LANDSAT imagery
[E78-10178] N78-29534

TROPOSPHERIC SCATTERING
DEMOD/decoder integration
[AD-A053685] N78-29319
Gain degradation and amplitude scintillation due to tropospheric turbulence
[NASA-CR-156796] N78-29668

TROPOSPHERIC WAVES
Tropical wave dynamics
[AD-A054302] N78-29706

TRUSSES
Extravehicular activity translation arm [EVATA] study
[NASA-CR-151755] N78-29145

TUBE HEAT EXCHANGERS
Heat transfer correlations for the nucleate, convective and dispersed regions of horizontal in-tube evaporation
N78-29965

TUNGSTATES
Metabolism of 181W-labeled sodium tungstate in goats
[FOA-C-40070-A3] N78-29732

TUNGSTEN
Direct observation of the point-defect structure of depleted-zones in ion-irradiated metals
N78-29213

TUNGSTEN CARBIDES
The hardness and deformation of tungsten carbide-cobalt alloys
N78-29211

TUNGSTEN ISOTOPES
Metabolism of 181W-labeled sodium tungstate in goats
[FOA-C-40070-A3] N78-29732

TURBINES
Wind energy statistics for large arrays of wind turbines, Great Lakes and Pacific Coast regions
[RLO/2439-77/2] N78-29590

TURBOCOMPRESSORS
Core compressor exit stage study. Volume 1: Blading design --- turbofan engines
[NASA-CR-135391] N78-29099
Computer program for relaxation solutions of the nonlinear small disturbance equations for transonic flow in an axial compressor blade row
[AD-A053744] N78-29412

TURBOFAN ENGINES
Core compressor exit stage study. Volume 1: Blading design --- turbofan engines
[NASA-CR-135391] N78-29099
Effect of steady flight loads on JT9D-7 performance deterioration
[NASA-CR-135407] N78-29105
Nuclear Bi-Brayton system for aircraft propulsion study
[AD-A054672] N78-29106
Turbine engine rotor dynamic evaluation. Volume 2: Engine and test rig balancing
[AD-A054533] N78-29108

TURBOFANS
Design of impact-resistant boron/aluminum large fan blade
[NASA-CR-135417] N78-29104

TURBOMACHINERY
Closed cycle Brayton turbomachinery research
[AD-A053024] N78-29586

TURBULENT BOUNDARY LAYER
Interpretation of the turbulent flow in the viscous wall region as a driven flow
[AD-A053404] N78-29411

TURBULENT FLOW
The response of turbulent shear flows to discontinuous changes in surface roughness
[ARL/MECH-ENG-REPT-150] N78-29403

TURBULENT JETS
Laws for the structure of turbulence of axisymmetrical jets in an accompanying current
[BLLD-M-25563-{5828.4F}] N78-29401

TURBULENT WAKES
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142

TWO DIMENSIONAL BODIES
Rate theory of a two-dimensional elasto-plastic continuum
[TAE-303] N78-29502

TWO DIMENSIONAL FLOW
An exact velocity potential solution of steady, compressible flow over arbitrary two-dimensional and axisymmetric bodies in simply connected fields
[AD-A054462] N78-29415
TODEP: A computer program for two dimensional wave propagation problems and deformation processes
[FOA-C-20184-D4] N78-29418

TWO PHASE FLOW
Computer simulation of non-Darcy two-phase flow in oil reservoirs
N78-29405

U

U.S.S.R.
US/USSR Symposium on Particulate Control [second]
[PB-279625/8] N78-29644

ULTRAHIGH FREQUENCIES
Influence of microwaves within the thermal intensity range in mice. Weight, rectal temperature, respiration, tread mill activity, reaction of senses, and learning
[FOA-C-54018-H2/H6] N78-29730

ULTRAHIGH VACUUM
Adhesion of gold in ultra-high vacuum
[BLL-PO-TRANS-3555-{7737.47}] N78-29210

ULTRASONIC RADIATION
Ultrasonic simulation of MSBLS multipath fading for orbiter landing configuration
[NASA-CR-151752] N78-29302
High resolution ultrasonic scanning of animal and human tissue in-vivo
[ORNL-TM-5934] N78-29742
Ultrasonics in medicine. Citations from the NTIS data base
[NTIS/PS-78/0494/1] N78-29879
Ultrasonics in medicine, volume 2. Citations from the engineering index data base
[NTIS/PS-78/0495/8] N78-29880

ULTRASONIC TESTS
Ultrasonic attenuation as a function of heat treatment and grain size in 79Ni6Mo-15Fe alloy
[SAND-78-0144] N78-29280
An ultrasonic pulse-height difference method of recording crack growth over an extended period
[ARL/MAT-NOTE-120] N78-29495

ULTRASONIC WAVE TRANSDUCERS
A phase insensitive ultrasonic transducer --- annealing cadmium sulfide crystals
[NASA-CASE-LAR-12304-1] N78-29871

ULTRASONICS
Use of ultrasonics in manufacturing procedures. A bibliography with abstracts
[NTIS/PS-78/0483/4] N78-29881

UNDERGROUND STRUCTURES
Wisconsin test facility ground terminal corrosion study --- inspection of underground electric cables
[AD-A053715] N78-29363
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006

UNDERWATER TESTS
Corrosion fatigue of cast propeller alloys in flowing seawater
[PB-279337/0] N78-29234

UNITED STATES OF AMERICA
US/USSR Symposium on Particulate Control [second]
[PB-279625/8] N78-29644

UNIVERSITIES
Canada report to COSPAR --- university research and space programs in Canada
N78-29126

UNIVERSITY PROGRAM
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering --- problem solving methods at the University of Houston
[NASA-CR-157364] N78-29820

UNSTEADY FLOW
Investigation of the unsteady airloads on wing-store configurations in subsonic flow
[NLR-MP-77025-U] N78-29073
An investigation of rotor noise generation by aerodynamic disturbance --- aeroacoustic transfer functions
[NASA-CR-157571] N78-29870

UPPER ATMOSPHERE
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661

UPWELLING WATER
Coastal upwelling ecosystems analysis. JOINT-II, the Thompson sections: R/V T. G. Thompson cruise 108
[PB-279173/9] N78-29718
Coastal upwelling ecosystems analysis. Vertical sections of temperature, salinity and sigma-T. JOINT-II-R/V Thomas G. Thompson Cruise 108 Leg 1
[PB-279174/7] N78-29719

URANIUM OXIDES
Structural evolution and electrical conductivity of sintered uranium dioxide
N78-29206

URBAN DEVELOPMENT
Airport development: Social and economic effects. A bibliography with abstracts
[NTIS/PS-78/0447/9] N78-29114
Methodology for analyzing effects of urbanization on water resource systems
[PB-279663/9] N78-29557
Adoption and utilization of urban technology: A decision-making study, analysis and conclusion, part 2
[PB-279541/7] N78-30010

URBAN PLANNING
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011

URBAN TRANSPORTATION
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-2] N78-29996
Urban transportation economics: Proceedings of five workshops on pricing alternatives, economic regulations, labor issues, marketing, and government financing responsibilities
[PB-279689/4] N78-30009

USER MANUALS [COMPUTER PROGRAMS]
System optimization of gasdynamic lasers, computer program user's manual
[NASA-TM-73193] N78-29436
The NASTRAN programmer's manual [level 16.0]
[NASA-SP-223{03}] N78-29505
The NASTRAN user's manual: Level 16.0 supplement
[NASA-SP-222{03}] N78-29506
Installation package for integrated programmable electronic controller and hydronic subsystem - solar heating and cooling
[NASA-CR-150747] N78-29580

Thermal model of laser-induced skin damage: Computer program operator's manual
[AD-A053416] N78-29738
Interactive Digital Receiver Simulator [IDRS] system user's manual and software documentation
[AD-A053684] N78-29799
USER REQUIREMENTS
Shifting the government's automatic data processing requirements to the private sector: Further study and better guidance needed
[PB-279482/4] N78-29783
Critical field experiments on uses of scientific and technical information
[PB-279693/6] N78-29980
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982

V

V/STOL AIRCRAFT
Technical data requirements for shipboard and shorebased vertical/short takeoff and landing V/STOL aircraft
[AD-A054102] N78-29093
High performance composites and adhesives for V/STOL aircraft
[AD-A054637] N78-29154
VACANCIES (CRYSTAL DEFECTS)
Calculations of atomic inner-shell vacancy yields and their dependence on collision parameters
N78-29886
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955
VACUUM APPARATUS
Structural design for a 10-GWh SMES vacuum vessel
[LA-7110-MS] N78-29514
VACUUM TUBES
Storage reliability of missile materiel program, electronic vacuum tube analysis
[AD-A053402] N78-29474
VALENCE
Analyzing X-ray valence band spectra by mathematical methods. Discussion and investigation of noise reduction, differentiation and deconvolution of spectra
[UCRL-TRANS-11326] N78-29227
VALVES
Test and evaluation of an aluminum oxide ball and seat in a ball valve
[MERC/RI-77/3] N78-29461
VANADIUM
Experimental studies of interfacial electro chemistry
N78-29158
VANADIUM ALLOYS
Thermodynamics of oxygen in solid solution in vanadium and niobium-vanadium alloys
N78-29174
VAPOR PHASES
Evaluation of a technique for sampling low concentrations of organic vapors in ambient air
[PB-279672/0] N78-29652
VECTOR ANALYSIS
Comparative testing of Niskin and Vector averaging current meters
[AD-A054113] N78-29428
VEGETATION
Measurement of soil moisture trends with airborne scatterometers
[E78-10176] N78-29532
A spectral method for determining the percentage of live herbage material in clipped samples
[NASA-TM-78019] N78-29544
Studies of air pollution effects on vegetation
[UCID-17714] N78-29634
The effect of wind and dew point on vegetative wetting duration
[PB-280041/5] N78-29708
VEHICULAR TRACKS
Radam phenomena of tracked vehicles
[AD-A053634] N78-29315
VELOCITY MEASUREMENT
Ocean thermal and current velocity data requirements for design of an OTEC Demonstration plant
[PB-280728/7] N78-29622
Aerodynamic particle size measurement by laser-Doppler velocimetry
N78-29627
VENTILATION
The accuracy of aspiration thermometers
[KNMI-WR-78-1] N78-29430
VENTILATORS
On estimating the sound radiation of large radial ventilators from acoustic measurements at a model test stand
[DLR-IB-257-77/2] N78-29878
VIBRATION
A new method of detecting defects in electronic devices --- by determining the jitter behavior
[BLL-PO-TRANS-3553-[7737.47]]
N78-29340
VIBRATION MODE
Singular perturbation of nonlinear regulators and systems with oscillatory modes
N78-29807
VIBRATION TESTS
Vibration of unreinforced pavement concrete
[PB-279148/1] N78-29292
Vibro-impact responses of a tube with tube-baffle interaction
[ANL-CT-78-11] N78-29510
VIDEO COMMUNICATION
The influence of transmission system on subjective picture quality
[BLL-PO-TRANS-3541-[7737.47]]
N78-29299
VIDEO EQUIPMENT
Concepts in real-time video tracking
[AD-A054475] N78-29320
PCM video recording using a rotating magnetic sheet
[NHK-LABS-NOTE-221] N78-29423
VIDICONS
Defect-free epitaxial layers for Si-vidicon targets
[NHK-LABS-NOTE-220] N78-29954
VIRGO STAR CLUSTER
A study of neutral hydrogen in early-type galaxies in the virgo cluster
N78-30020
VISCOELASTICITY
Dynamic response of a geometrically non-linear elastic/viscoelastic cylinder
N78-29491
Stress analysis of a viscoelastic material in the calendering process
N78-29493
Viscoelastic buckling of shells
[FFA-TN-HU-1911] N78-29523
VISCOMETERS
A temperature controlled water bath for viscosity measurement
[NPL-MOM-24] N78-29281
VISCOSITY
The behaviour of centrifugal pumps operating with heavy oils
[ME/77/28] N78-29450
VISCOUS FLOW
An energy method for analyzing wave propagation in viscous flow in an elastic tube surrounded by an elastic medium
N78-29399
Interpretation of the turbulent flow in the viscous wall region as a driven flow
[AD-A053404] N78-29411
Analysis and numerical solution of three-dimensional viscous internal flow problems
[AD-A053692] N78-29413
An optimization study for generating surface-oriented coordinates for arbitrary bodies in high re-flow
[AD-A054047] N78-29414
VISIBILITY
Impairment of picture signals and subjective quality in digital coding: Edge business visibility
[BLL-PO-TRANS-3516-[7737.47]]
N78-29298
VISUAL DISCRIMINATION
The computation of immediate texture discrimination
[AD-A053804] N78-29810
VISUAL OBSERVATION
Semiconductor measurement technology: Automated photomask inspection --- used in fabrication of integrated circuits
[PB-279336/2] N78-29488
VISUAL PERCEPTION
The apparent rate of flicker
[NHK-LABS-NOTE-219] N78-29748
VOLTAGE CONVERTERS (DC TO DC)
Measurement techniques for the characterization in the frequency domain of regulated energy-storage DC-to-DC converters
[NASA-CR-157474] N78-29349
Modeling and Analysis of Power Processing Systems [MAPPS], initial phase 2
[NASA-CR-135173] N78-29350
Modelling, analyses and design of switching converters
[NASA-CR-135174] N78-29351
VOLTERRA EQUATIONS
An integral representation for eigenfunctions of linear ordinary differential operators
[AD-A054543] N78-29832
A Fubini theorem for iterated stochastic integrals
[AD-A054545] N78-29847
VORTICES
Wake vortex technology
N78-29055
VULNERABILITY
Impact vulnerability of scratched glass lenses
[AD-A053421] N78-29904

W

WALL FLOW
Interpretation of the turbulent flow in the viscous wall region as a driven flow
[AD-A053404] N78-29411
WALLS
Suppression of perforated wall in a transonic wind tunnel and the effects on aerodynamic data
[AD-A054417] N78-29876
WALSH FUNCTION
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
N78-29766
Walsh functions. A bibliography with abstracts
[NTIS/PS-78/0508/8] N78-29978
WARNING SYSTEMS
Aircraft hazard detection and control utilizing an aircraft data acquisition system
[AD-A054416] N78-29092
Severe storms: Prediction, detection, and warning. A report of the Panel on Shortrange Prediction and the Panel on Severe Storms to the Committee on Atmospheric Sciences Assembly of Mathematical and Physical Sciences.
[PB-279306/5] N78-29715
WASTE DISPOSAL
A study of the feasibility of utilizing solid wastes for building materials. Phase 1, summary report
[PB-279440/2] N78-29286
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
Aquatic disposal field investigations, Eatons Neck disposal site, Long Island Sound. Appendix B: Water-quality parameters and physicochemical sediment parameters
[AD-A053427] N78-29630
St. Louis demonstration: Power plant equipment, facilities and environmental evaluations
[PB-279828/8] N78-29655
Neutralization of organic substances in waste water by plants
[AD-A053435] N78-29728
Water problems in the rural environment: Alternative solutions for water supply and waterwaste disposal
[PB-279775/1] N78-29969
Operations manual: Sludge handling and conditioning
[PB-279449/3] N78-30002
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007
WASTE ENERGY UTILIZATION
Thermal energy storage for industrial waste heat recovery
[NASA-TM-78953] N78-29576
WASTE UTILIZATION
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the NTIS data base
[NTIS/PS-78/0499/0] N78-29266
Synthetic fuels from municipal, industrial, and agricultural wastes. Citations from the American Petroleum Waste Institute data base
[NTIS/PS-78/0500/5] N78-29267
A study of the feasibility of utilizing solid wastes for building materials. Phase 1, summary report
[PB-279440/2] N78-29286
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
WASTE WATER
Biodegradation of shipboard wastewater in collection, holding, and transfer tanks
[AD-A053643] N78-29726
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water --- using Amberlite ion exchange resins to trap oily pollutants in water
[AD-A053652] N78-29997
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001
Operations manual: Sludge handling and conditioning
[PB-279449/3] N78-30002
Field manual for performance evaluation and troubleshooting at municipal wastewater treatment facilities
[PB-279448/5] N78-30003
Package treatment plants: Operations manual
[PB-279444/4] N78-30004
WATER
A temperature controlled water bath for viscosity measurement
[NPL-MOM-24] N78-29281
Heat transfer during transition from film to nucleate boiling of water in force convection upward flow
N78-29398
Neutralization of organic substances in waste water by plants
[AD-A053435] N78-29728

Nuclear resonance in dispersed systems --- oil/water ratios in liquid crystals and microemulsions
N78-29950
WATER CIRCULATION
Model studies of Lake Erie --- water circulation variations
N78-29528
WATER CURRENTS
Comparative testing of Niskin and Vector averaging current meters
[AD-A054113] N78-29428
WATER MANAGEMENT
Retransmission of hydrometric data in Canada
[E78-10174] N78-29531
Development of a subsurface hydrologic model and use for integrated management of surface and subsurface water resources
[PB-279629/0] N78-29554
Municipal and industrial water conservation-the Federal government could do more
[PB-279487/3] N78-29556
Concepts and techniques for evaluation of energy-related water problems
[PB-279608/4] N78-29619
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011
WATER POLLUTION
The use of satellite imagery for lake classification in Wisconsin
[PB-279628/2] N78-29558
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 1: Executive summary
[PB-279635/7] N78-29638
Controlling SO2 emissions from coal-fired steam-electric generators; water pollution impact. Volume 2: Technical discussion
[PB-279636/5] N78-29639
Mercury pollution, volume 1. A bibliography with abstracts
[NTIS/PS-78/0479/2] N78-29642
Mercury pollution, volume 2. A bibliography with abstracts
[NTIS/PS-78/0480/0] N78-29643
National water quality inventory 1976 report to Congress
[PB-279462/6] N78-29647
Phytoplankton sampling in quantitative baseline and monitoring programs
[PB-279644/9] N78-29733
Aeration of sewage lagoons, reservoirs, and streams. Citations from the engineering index data base
[NTIS/PS-78/0434/7] N78-29999
Aeration of sewage lagoons, reservoirs, and streams. Citations from the NTIS data base
[NTIS/PS-78/0433/9] N78-30000
WATER QUALITY
Investigations into the determination of trace levels of iron, Part 1: A field method for the determination of EDTA in natural water
N78-29159
Aquatic disposal field investigations, Eatons Neck disposal site, Long Island Sound. Appendix B: Water-quality parameters and physicochemical sediment parameters
[AD-A053427] N78-29630
Survey of models to predict the effect of geothermal power development on domestic water supplies and to design pollution monitoring methods
[UCRL-79977] N78-29637
Sediment and water quality: A review of the literature including a suggested approach for water quality criteria with summary of workshop and conclusions and recommendations
[PB-279469/1] N78-29646
National water quality inventory 1976 report to Congress
[PB-279462/6] N78-29647
Seagrass literature survey
[AD-A054480] N78-29729
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011
WATER RECLAMATION
Breadboard wash water renovation system --- using ferric chloride and ion exchange resins to remove soap and dissolved salts
[NASA-CR-151818] N78-29993
WATER RESOURCES
Retransmission of hydrometric data in Canada
[E78-10174] N78-29531
Development of a subsurface hydrologic model and use for integrated management of surface and subsurface water resources
[PB-279629/0] N78-29554
California Water Resources Center
[PB-279614/2] N78-29555
Methodology for analyzing effects of urbanization on water resource systems
[PB-279663/9] N78-29557
Cooperative Instream Flow Service Group: The first year
[PB-279496/4] N78-29562
Concepts and techniques for evaluation of energy-related water problems
[PB-279608/4] N78-29619
Multiple water supply approach for urban water management --- mathematical model
[PB-279768/6] N78-30011
WATER RUNOFF
Derivation of initial soil moisture accounting parameters from soil properties for the National Weather Service River Forecast System
[PB-210710/5] N78-29560
WATER TEMPERATURE
Variability of water temperature in the Atlantic near the equator --- GARP Atlantic Tropical Experiment
[BLLD-M-24959-[5828.4F]] N78-29717
WATER TREATMENT
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654
Biodegradation of shipboard wastewater in collection, holding, and transfer tanks
[AD-A053643] N78-29726
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001
WATER VAPOR
Water vapor permeability of plastic fast packs
[AD-A054509] N78-29254
WATERSHEDS
Hydrologic simulation in a semi-arid region --- Jordon watershed model
N78-29527
Watershed Research in Eastern North America. Volume 1: A workshop to compare results
[PB-279919/5] N78-29549
Watershed Research in Eastern North America. Volume 2: A workshop to compare results
[PB-279920/3] N78-29550
WAVE INTERACTION
Nonlinear Landau damping in the ionosphere
[NASA-TM-79595] N78-29672
Effect of lower hybrid waves on the evolution of the Doublet 2A plasma
[GA-A-14809] N78-29921
Coupling of lower hybrid waves in the doublet 2A high power RF heating experiments
[GA-A-14808] N78-29922
WAVE PROPAGATION
Amplitude scintillations on earth-space propagation paths at 2 and 30 GHz
[NASA-CR-156785] N78-29307
A compendium of millimeter wave propagation studies performed by NASA
[NASA-CR-156781] N78-29309
Propagation of microwave satellite communication signals through striated media
[AD-A054677] N78-29324
An energy method for analyzing wave propagation in viscous flow in an elastic tube surrounded by an elastic medium
N78-29399
TODEP: A computer program for two dimensional wave propagation problems and deformation processes
[FOA-C-20184-D4] N78-29418
Study of shoaling waves in the laboratory
N78-29716
Radiation phenomena of plasma waves. Part 1: Fundamental radiation theory
[IPPJ-336-PT-1] N78-29915
WAVE SCATTERING
Focused laser beam scattering by stationary and moving particles: A theoretical study
N78-29433
Surface acoustic wave scattering from grooves in piezoelectric substrates
N78-29952
WAVEFORMS
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328
WAVELENGTHS
Evaluation of wavelength groups for discrimination of agricultural cover types --- remote sensing of environment in INDIANA
[NASA-CR-157393] N78-29536
WAVES
An investigation of the growth and decay of long and synoptic-scale waves
N78-29294
WEAK ENERGY INTERACTIONS
Phenomenology of neutral current interactions --- hadrons, bosons, neutrinos and weak energy interactions
N78-29888
WEAPON SYSTEMS
Integration and application of human resource technologies in weapon system design
[AD-A053681] N78-29756
Integration and application of human resource technologies in weapon system design: Coordination of five human resource technologies
[AD-A053680] N78-29757
WEAR TESTS
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials --- wear tests of gas turbine engine seals
[NASA-TM-78967] N78-29215
Wear tests with PTFE-bearings at varying loads
[FFA-TN-HU-1755] N78-29462
WEATHER FORECASTING
An examination of the weather graphics system [digital facsimle] acquisition
[AD-A053567] N78-29701
Utility of agricultural weather services in the mid-South
[PB-280943/2] N78-29711
NOAA climate program --- climate effects on agriculture, energy consumption and fishery production
[PB-281195/8] N78-29712
The value of improved forecasts of climate for agricultural decision making
[PB-279452/7] N78-29713
Severe storms: Prediction, detection, and warning. A report of the Panel on Shortrange Prediction and the Panel on Severe Storms to the Committee on Atmospheric Sciences Assembly of Mathematical and Physical Sciences.
[PB-279306/5] N78-29715
WEATHERING
Estimates from satellites of weather erosion parameters for reentry systems
[AD-A053654] N78-29136
Testing the stability of high-density polyethylene --- oxidation resistance, weathering, and durability
[BLL-PO-TRANS-3564-[7737.47]] N78-29243
WEIGHTING FUNCTIONS
The time-sequenced adaptive filter
N78-29343
A set of orthogonal polynomials that generalize the racah coefficients or 6 -J symbols
[AD-A054552] N78-29835
Densities of states and spectral weight functions for disordered systems
N78-29939
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-2] N78-29996
WEIGHTLESSNESS
Modification of the continuous flow diffusion chamber for use in zero-gravity --- atmospheric cloud physics lab
[NASA-CR-150765] N78-29123
WEIGHTLESSNESS SIMULATION
Modification of the continuous flow diffusion chamber for use in zero-gravity --- atmospheric cloud physics lab
[NASA-CR-150765] N78-29123
WELDED JOINTS
Weldbraze airframe components
[AD-A054042] N78-29457
Predicted effects of residual stresses on butt weld fatigue life
N78-29494
Handling of fatigue data in computer analysis
N78-29498
WELDED STRUCTURES
Automatic control of weld penetration
[AD-A054026] N78-29456
WELDING
Effect of spot and stud welding on ESR 4340 steel armor
[AD-A054025] N78-29455
Weldbraze airframe components
[AD-A054042] N78-29457
WHEELS
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525
WHITE NOISE
Studies in the analysis of serially dependent data
[AD-A054556] N78-29838
WIDE ANGLE LENSES
Image collapsing concentrators
[ALO-33] N78-29600
WIND [METEOROLOGY]
Evaluation of the FIB methodology for application to cloud motion wind data
[AD-A053620] N78-29703
WIND MEASUREMENT
Wind energy statistics for large arrays of wind turbines, Great Lakes and Pacific Coast regions
[RLO/2439-77/2] N78-29590
WIND PROFILES
Dynamics of stratospheric winds in the Southern Hemisphere
[INPE-1065-PE/064] N78-29670
WIND SHEAR
Simulation and analysis of wind shear hazard --- for aircraft landing and takeoff
[NASA-CR-157470] N78-29699
WIND TUNNEL MODELS
Infrared radiometer for measuring thermophysical properties of wind tunnel models
[NASA-CR-158898] N78-29426

WIND TUNNEL TESTS
Wind tunnel investigation of computationally optimized variable camber wing configurations
[NASA-TM-78479] N78-29067
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1 --- supersonic cruise aircraft research wind tunnel tests
[NASA-CR-135189-VOL-1] N78-29867
WIND VELOCITY
The accuracy of aspiration thermometers
[KNMI-WR-78-1] N78-29430
The effect of wind and dew point on vegetative wetting duration
[PB-280041/5] N78-29708
Seasonal description of winds and surface and bottom salinities and temperatures in the northern Gulf of Mexico
[PB-280748/5] N78-29720
WINDPOWERED GENERATORS
Large wind turbine generators
[NASA-TM-73767] N78-29575
The 200-kilowatt wind turbine project
[NASA-TM-79757] N78-29583
WINDSHIELDS
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings --- damage to windshields and canopies
[AD-A054225] N78-29372
WING LOADING
Development and flight evaluation of active controls in the L-1011 --- including wing load alleviation and stability augmentation
N78-29051
A theoretical investigation of ground effects on USB configurations
[NASA-CR-157355] N78-29086
WING TIPS
Application of winglets and/or wing tip extensions with active load control on the Boeing 747
N78-29050
WINGLETS
Experimental results of winglets on first, second, and third generation jet transports --- to reduce drag coefficient
N78-29048
Winglet and long duct nacelle aerodynamic development for DC-10 derivatives
N78-29049
Application of winglets and/or wing tip extensions with active load control on the Boeing 747
N78-29050
WINGS
Calculation of the interference between civil-military transport aircraft engine and basis wing according to the vortex conductor procedure
[DLR-IB-151-77/19] N78-29075
Effect of chordwise forces and deformations and deformations due to steady lift on wing flutter
[AD-A053640] N78-29110
WINTER
An investigation of the growth and decay of long and synoptic-scale waves
N78-29294
WIRE
Processes of plastic deformation, their conditions and effect on the properties of the final product
[LA-TR-77-68] N78-29279
WIRELESS COMMUNICATIONS
Communications Link Characterization Experiment [CLCE], volume 3
[NASA-CR-156801] N78-29306
WISCONSIN
Wisconsin test facility ground terminal corrosion study --- inspection of underground electric cables
[AD-A053715] N78-29363
The use of satellite imagery for lake classification in Wisconsin
[PB-279628/2] N78-29558
WORDS [LANGUAGE]
Word hypothesization for large-vocabulary speech understanding systems
N78-29789
WRINKLING
Effects of geometric nonuniformities on the stresses in piping elbows
[WARD-SD-3045-7] N78-29513

X

X RAY ANALYSIS
Analyzing X-ray valence band spectra by mathematical methods. Discussion and investigation of noise reduction, differentiation and deconvolution of spectra
[UCRL-TRANS-11326] N78-29227
X RAY ASTRONOMY
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3 --- periodic variations
[NASA-TM-79605] N78-30018
X RAY DIFFRACTION
High-pressure X-ray diffraction study of linear polyethylene
N78-29240
X RAY IRRADIATION
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals --- l-alanine, triglycine sulfate, and 3-hydroxyanthine
N78-29935
X RAY SOURCES
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH
[NASA-CR-157356] N78-29539
Observations of three binary X-ray sources: CYG X-1, CYG X-2, and 4U1813+50 [AM HER]
N78-30016
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3 --- periodic variations
[NASA-TM-79605] N78-30018
X RAY TELESCOPES
Primary aberrations for grazing incidence
N78-29900

Y

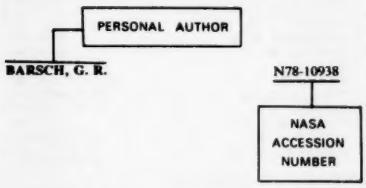
YAG LASERS
Manufacturing methods and technology engineering for neodymium doped YAG laser rods
[AD-A054224] N78-29441
Plasma scattering experiments with a periodic Nd:YAG laser at 1.06 micron and a Si-avalanche detector
[IPF-78-2] N78-29446
YTTRIUM COMPOUNDS
Reactions of yttria-stabilized zirconia with oxides and sulfates of various elements
[NASA-TM-78942] N78-29216
YTTRIUM-ALUMINUM GARNET
Solid state formation of Nd:Y sub 3 Al sub 5 O sub 12 Nd YAG
[AD-A054428] N78-29959

Z

ZEOLITES
Active sites of dealuminated hydrogen mordenite
N78-29179
ZINC
Adhesion of electrolytic zinc to aluminum cathodes
[BLL-RTS-10973] N78-29209
Adhesion of a bimetallic interface --- for Al, Mg, and Zn
[NASA-TM-78890] N78-29214
Toxicological investigation of zinc and titanium smoke compositions. A literature study
[FOA-C-40072-H2] N78-29744
ZIRCONIUM
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955
ZIRCONIUM ALLOYS
Reactions of yttria-stabilized zirconia with oxides and sulfates of various elements
[NASA-TM-78942] N78-29216

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABBAS, M. M. N78-30027
ABSTON, C. C. N78-29696
ABU-EL-HAIJA, A. I. N78-29348
ADAMS, E. B. N78-29982
ADAMS, L. G. N78-29153
AESCHLIMAN, D. P. N78-29603
AFRASHTEH, A. N78-29530
AHEARN, J. F. N78-29353
AHMED, S. R. N78-29072
AKAVIA, G. Y. N78-29295
AL-ZAKRI, A. S. N78-29396
ALARID, J. E. N78-29191
ALBERTY, R. N78-29714
ALBRIGHT, N. N78-29408
N78-29409
ALBRITTON, D. L. N78-29685
ALDRIDGE, M. H. N78-29997
ALEX, C. G. N78-29377
ALEXANDER, S. S. N78-29574
ALFORD, W. J., JR. N78-29047
ALKE, R. B. N78-29282
N78-29283
ALLEN, J. H. N78-29696
ALLISON, R. L. N78-29050
ALM, K. F. N78-29228
AMARO, J. N78-29611
ANDERS, F. N78-29776
ANDERSON, C. A. N78-29514
ANDERSON, G. D. N78-29687
ANDERSON, J. J. N78-29722
ANDERSON, J. L. N78-29060
ANDERSON, L. R. N78-29829
ANDERSSON, L. H. N78-29264
ANDREWS, H. C. N78-29329
ANGELAKOS, D. J. N78-29303
ARCHBOLD, E. N78-29517
ARMAND, M. N78-29218
ARMSTRONG, B. L. N78-29560
ARMSTRONG, J. E. N78-29973
ARNOLD, J. M. N78-29053
AROIAN, L. A. N78-29849
N78-29850
N78-29851
N78-29852
ASK, H. R. N78-29974
ASKEY, R. N78-29835
ASKREN, W. B. N78-29756
N78-29757
ATHAY, R. J. N78-29765
ATWOOD, M. E. N78-29754
AUSNESS, R. N78-29553
AVILA, P. G. N78-29822
AYER, F. A. N78-29644

B

BAER, M. E. N78-29537
BAHL, S. K. N78-29187
BAHLER, D. D. N78-29349
BALKE, K. D. N78-29601
BALKO, B. N78-29680
BALLDIN, U. N78-29761
BALLHAUS, W. F. N78-29067
BANAI, E. N78-29243
BANSAL, R. K. N78-29964
BANTON, M. E. N78-29928
BARBARIKA, H. F. N78-29656
BARBER, M. R. N78-29055
BARBINI, P. N78-29382
N78-29856
BARBOSA, M. P. N78-29540
BARDEN, J. D. N78-29652
BARTENWERFER, M. N78-29878
BARTHELEMY, J. L. N78-29113
BARTON, E. D. N78-29719
N78-29502
BARUCH, M. N78-29154
BASCOM, W. D. N78-29795
BASIL, V. R. N78-29187
BAUGHMAN, R. H. N78-29168
BAXTER, D. N. N78-29975
BAYER, B. N78-29985
BAYLEY, S. N78-29352
BEALL, J. R. N78-29594
BEARDSWORTH, E. N78-29426
BECKER, E. C. N78-29602
BECKER, H. S. N78-29112
BEHMKE, D. L. N78-29287
BELANGER, B. C. N78-29107
BELL, W. A. N78-29645
BELLA, D. A. N78-29319
BELLO, P. A. N78-29657
BEMIS, G. R. N78-29804
BENNETT, B. I. N78-29514
BENNETT, J. G. N78-29657
BENSON, P. E. N78-29672
BENSON, R. F. N78-29902
BERGEN, G. J. N78-29847
BERGER, M. A. N78-29363
BERGSCHNEIDER, P. V. N78-29620
BERGSTRESSER, K. N78-29620
BERNEY, R. E. N78-29508
BERNSTEIN, B. N78-30035
BERTSCH, D. L. N78-29293
BESSELIEVRE, W. C. N78-29312
BETTS, W. L. N78-29249
BEYER, R. A. N78-29243
BEZUR, L. N78-29124
BHAVSAR, P. D. N78-29449
BHUSHAN, B. N78-29997
BIGELOW, S. W. N78-29974
BIKOWSKI, J. N78-29215
BILL, R. C. N78-30006
BIRKMYER, J. N78-29361
BIS, R. F. N78-29718
BISHOP, D. D. N78-29127
BLACK, H. D. N78-29566
BLAHA, R. J. N78-29532
BLANCHARD, B. J. N78-29956
BLEHA, W. P. N78-29082
BLEWITT, S. J. N78-29691
BLOCK, L. P. N78-29362
BLOOMQUIST, D. D. N78-29887
BODWIN, G. T. N78-29466
BOHN, P. F. N78-30018
BOLDT, E. A. N78-29998
BOLGER, J. G. N78-29610
BOND, T. E. N78-29428
BONDE, L. W. N78-29323
BOOKER, H. C. N78-29205
BORATTO, F. J. M. N78-29352
BORENSTEIN, M. D. N78-29422
BORILE, F. N78-29918
BORIS, J. N78-29717
BORISOV, B. G. N78-29967
BORSATO, N. N78-29347
BOSE, A. K. N78-29298
BOUDEVILLE, J. L. N78-29044
BOUSMAN, W. G. N78-29460
BOWERS, W. M. N78-29521
BOWLES, C. Q. N78-29846
BOX, G. E. P. N78-29465
BOYD, H. N78-29621
BOYD, J. H. N78-29219
BOYD, W. K. N78-29234
N78-29110
BOYD, W. N. N78-29799
BOZEK, R. E.
BRACHA, E. N78-29766
BRADLEY, O. D. N78-29760
BRAHM, C. B. N78-29974
BRANCH, M. C. N78-29603
BRANDQVIST, L. N78-29813
BREDA, J. C. N78-29799
BREEDLOVE, J. R., JR. N78-29546
BREEN, J. E. N78-29278
BREMER, J. N78-29309
BREWER, J. E. N78-29373
BRIDGES, K. M. N78-29729
BRIGGS, F. C., JR. N78-29093
BRITTON, C. V. N78-29934
BRITTON, E. G. N78-29767
BROCK, J. R. N78-29658
BROCK, L. N78-29974
BROOKS, D. E. N78-29182
BROOKS, N. H. N78-29921
BROWN, D. B. N78-29250
BROWN, R. J. N78-29642
N78-29643
N78-29999
N78-30000
BROWN, S. C. N78-29698
BROWNLOW, J. N78-29843
BRUNSVOLD, R. S. N78-29845
BRUSSAT, T. R. N78-29509
BRYANT, C. M. N78-29482
BUCKMASTER, J. D. N78-29189
N78-29190
BUFFUM, D. C. N78-29455
N78-29456
BUIVAN, N. A. N78-29670
BULFIN, R. L. N78-29981
BULLARD, C. W. N78-29598
BUMGARNER, B. N78-29714
BUNAKOV, Y. N. N78-29452
BUNDE, D. C. N78-29768
BUNTING, J. T. N78-29136
BURGOON, S. L. N78-29976
BURK, J. D. N78-29494
BURKHOLDER, S. D. N78-29368
BURLAGA, L. F. N78-30023
BUSEMANN, A. N78-30022
BUSH, L. F. N78-29097
BUSSARD, R. N78-30037
BUTLER, R. D. N78-29262
BUZZELLI, E. S. N78-29604

C

CALDWELL, J. L. N78-29816
CALFEE, R. F. N78-29695
CALOGERAS, J. E. N78-29577
CALVERT, S. N78-29656
CALVO, R. N78-29106
CAMPBELL, C. N78-29842
CAMPBELL, E. M. N78-29442
CAMPBELL, R. P. N78-29459
CAMPBELL, T. G. N78-29310
CANTOR, A. N78-29077
CANTRELL, J. H., JR. N78-29742
CARCIELLO, N. N78-29611
CARDIASMENOS, A. G. N78-29434
CARDWELL, C. N78-29721
CARLIN, C. M. N78-29101
N78-29102
CARLSON, C. T. N78-29702
CARLSSON, G. N78-29462
CARMICHAEL, R. F. N78-29284
CARNES, J. G. N78-29791
N78-29794
CARTER, L. F. N78-29620
CASLAVSKY, J. L. N78-29959
CATEORA, J. V. N78-29334
CATTOLICA, R. J. N78-29603
CAUDLE, J. M. N78-29573
CAVAGNARO, D. M. N78-29269
N78-29270
N78-29271
CEGLIO, N. M. N78-29925
CELSODECARVALHO, V. C. N78-29541
CHACKO, C. C. N78-29680
CHAKRAVARTY, S. N78-29911
CHAN, V. S. N78-29922

CHANARATINA, V. N78-29923
CHANDLER, J. E. N78-29490
CHANG, C. P. N78-29239
CHANG, D. Y. C. N78-29706
CHANG, K. J. N78-29769
CHAO, N. N78-29511
CHASE, D. N78-29758
CHEN, N. F. N78-29319
CHEN, N. J. N78-29408
N78-29282
N78-29283
CHENG, W. H. N78-29770
CHESTER, G. V. N78-29911
CHI, C. N. N78-29294
CHIANG, L. C. N78-29540
CHIU, C. W. N78-29236
CHIU, S. T. N78-29509
CHOI, M. F. N78-29259
CHOW, J. H. N78-29807
CHOY, C. K. A. N78-29809
CHRISTENSON, J. A. N78-29106
CHUNG, C. W. N78-29315
CIARLO, D. R. N78-29488
CLARK, T. J. N78-30008
CLARKE, B. H. N78-29151
CLARKE, W. R. N78-29093
CLAYDON, C. R., JR. N78-29976
CLELAND, L. L. N78-29379
CLEMENA, G. G. N78-29285
CLEMENT, J. J. N78-29346
CLEMENT, W. F. N78-29699
CLEMESHA, B. R. N78-29667
CLOUGH, G. A. N78-29933
COCKAYNE, J. E. N78-29128
CODISPOTI, L. A. N78-29718
COE, H. D. N78-29106
COFFEY, H. E. N78-30031
N78-30032
COHEN, N. V. N78-29310
COHEN, R. S. N78-30021
COHN, M. M. N78-30008
COLAK, S. N78-29433
COLE, B. E. N78-29661
COLE, J. N. N78-29872
COLEMAN, C. L. N78-29740
COLEMAN, H. W. N78-29603
COLEMAN, L. W. N78-29442
COLLETT, C. R. N78-29147
COLSON, R. N78-29377
COMBS, S. R. N78-29345
CONCUS, P. N78-29408
N78-29409
CONOVER, J. H. N78-29136
COOKE, D. W. N78-29935
CORRELL, D. L. N78-29549
CORWIN, R. R. N78-29426
COSGROVE, D. V. N78-29100
COUNSELL, J. F. N78-29193
N78-29194
CRAIG, B. L. N78-29185
CRAIG, J. N78-29132
CRAINE, L. B. N78-29620
CREPANI, E. N78-29540
CRIBORN, C. O. N78-29730
CRITCHER, A. R. N78-29785
CROCKETT, P. W. N78-29879
N78-29880
CROOM, D. R. N78-29055
CROWE, C. R. N78-29224
CUK, S. N78-29351
CULLEN, M. J. P. N78-29828
CULP, G. L. N78-30003
CULP, R. D. N78-30022
CUNNINGHAM, L. K. N78-29289
CURTIS, A. R. N78-29839
CUSUMANO, J. A. N78-29596

D

DALLEK, S. N78-29587
DANGELO, W. M. N78-29997
DASILVA, D. C. M. N78-29792
DASILVAARAGAO, M. R. N78-29671
DASILVAMARTINS, I. N78-29793
DAVIDSON, L. N. N78-29272
DAVIDSON, P. N78-29187
DAVIES, M. E. N78-30025
DAVIS, D. D. N78-29334
DAVIS, J. N78-29108
DEAN, A. M. N78-29185
DEB, A. K. N78-30011
DECKER, G. N78-29930
DECOCK, J. N78-29520
DECOSTER, R. J., II N78-29908
DEFOREST, S. N78-29674
DEGELAS, B. N78-29218
DEGRAAF, E. A. B. N78-29483
DEHASETH, J. A. N78-29169
DEJARNETTE, H. M. N78-29224
DEJONGE, J. B. N78-29096
DEKLUIVER, H. N78-29929
DELIL, A. A. M. N78-29420
DELRE, E. N78-29330
DEMORAESNOVO, E. M. L. N78-29543
DENTON, M. B.
DENTZ, D.
DENYS, R.
DEOLIVEIRA, J. R.
DEREMER, R. K.
DERR, V. E.
DESA, D. F.
DESENA, B. J.
DEVASIRVATHAM, D. M. J.
DICK, J. J.
DIEGLE, R. B.
DIPERNA, R. J.
DIXON, R. D.
DOBESCH, H.
DOEBELE, H. F.
DONASCIMENTO, F. S.
DONOVAN, S. S.
DONOVON, R. M.
DOOLEY, J.
DORNER, B. C.
DORNIK, S. E.
DORY, R. A.
DOSANJOS, C. E.
DOSSANTOS, A. P.
DOSSANTOS, A. R.
DOSSANTOS, U. P.
DOTY, R. N.
DOUGLAS, M.
DOW, T. A.
DRACK, H.
DREICER, H.
DRESSLER, G. J.
DRIVER, C.
DUFT, B. L.
DULGEROFF, C. R.
DUNHAM, R. E., JR.
DUNKLE, H. D.
DUNLAP, R. C.
DURBAN, D.
DURFEE, R. L.
DURLAK, E. R.
DUSCHA, R. A.
DUTRA, S. L. G.
DUTTA, S.
DUVALL, G. E.
DWIGHT, K.
DYETT, D.

E

EASTMAN, J. M.
EBERIUS, H.
ECKSTEIN, A. J.
ECKSTEIN, M. C.
EDELMAN, R. B.
EDLUND, V. E.
EFTEKHARI, M. R.
EGBERT, D. E.
EINARSSON, B.
EISNER, A.
EKLUNDH, J. O.
EKMAN, L.
EKSTROM, M. P.
EL-ZIQ, Y. M.
ELIAS, J. H.
ELIAS, M.
ELLENDER, J. H.
ELVERS, E.
EMERY, M.
ENDERS, J. H.
ENDLICH, R. M.
ENDO, Y.
ENGLISH, J. M.
ENNOS, A. E.
ERICKSON, R. H.
ERNST, D. W.
ESPOSITO, L. W.
ETHRIDGE, N. H.
ETTLICH, W. F.
EVANS, J. M., JR.
EWUSI-MENSAH, K.

F

FANG, R. C. Y.
FARRELL, A. J.
FARRIOR, D. S.
FEDOCK, J. J.
FEHSENFELD, F. C.
FELTER, T. E.
FERGUSON, E. E.
FERRANTE, J.
FERRANTE, M. J.
FERRARA, E. R., JR.
FESTA, J. F.
FICKE, E. R.
FICKE, J. F.
FIGUEIRAS, H. D.
FILHO, O. R.
FINN, R.
FINNIGAN, J. C. N78-29970
FISCHER, C. F. N78-29805
FISCHER, J. R. N78-29904
FISCHER, R. N78-29498
FISCUS, D. E. N78-29655
FISHER, B. D. N78-29056
FITZGERALD, A. N78-29840
FITZGERALD, R. M. N78-29875
FLAHERTY, D. C. N78-29562
FLANAGAN, J. B. N78-29170
FLECHNER, S. G. N78-29048
FLEMMING, L. N78-29930
FLICK, R. E. N78-29716
FLOWER, W. L. N78-29603
FOGEL, M. B. N78-29963
FONTANA, J. N78-29611
FONTHEIM, E. G. N78-29678
FORGAC, J. M. N78-29237
FORSYTHE, K. H. N78-29238
FORTAK, H. N78-29633
FOTI, S. C. N78-29361
FOX, D. G. N78-29092
FOYT, A. G., JR. N78-29907
FRANKE, J. M. N78-29435
FREEMAN, R. L. N78-29921
FREESE, K. B. N78-29927
FRIBOURG, H. A. N78-29709
N78-29710
FRIEBERTSHAUSER, M. A. N78-29718
FRIEDERICH, G. E. N78-29718
FRIEDHOFF, L. T. N78-29161
FRIEDMAN, M. N78-29893
FRIESEN, M. D. N78-29171
FRITTS, M. N78-29918
FROECHTENIGT, J. F. N78-29146
FROHNING, D. N78-29581
FROULA, N. H. N78-29223
FUEHRING, H. N78-29489
FUJIMOTO, W. T. N78-29095
FUJIWARA, K. N78-29210
FUKUDA, T. N78-29748
FULLER, P. M. N78-29724
FURMAN, M. A. N78-29944

G

GALLAGHER, J. P. N78-29095
GALLO, J. G. N78-29507
GAMMON, R. W. N78-29892
GAMON, M. A. N78-29084
GANGOTENAGONZALEZ, E. S. N78-29937
GANN, R. C. N78-29911
GARDER, J. N78-29918
GARDNER, J. F. N78-29461
GASSMANN, F. N78-29632
GATTI, A. N78-29252
GAUBIS, P. A. N78-29938
GAULT, A. N78-29988
GAULT, D. E. N78-30025
GAUSTER, W. F. N78-29962
GEHL, S. M. N78-29206
GELIN, B. N78-29264
GELLMAN, A. J. N78-29045
GENGE, M. F. N78-29363
GENNARO, A. N78-29903
GEOFFRIONI, A. M. N78-29802
GERARD, M. N78-29118
GERARDI, A. G. N78-29087
GERHARZ, J. J. N78-29500
GERRITY, T. R. N78-29945
GEYER, A. T. N78-29726
GHIA, K. N. N78-29413
GHIA, U. N78-29413
N78-29414
GIAQUINTA, A. R. N78-29563
GIESKE, J. H. N78-29280
GILBERT, A. L. N78-29320
GILBERT, R. J. N78-29599
GILES, M. K. N78-29320
GLAROS, S. S. N78-29442
GLASSMAN, A. J. N78-29884
GLENN, H. D. N78-29688
GLUCK, M. S. N78-29734
GLUGLA, P. G. N78-29163
GOANS, R. E. N78-29742
GOCLOWSKI, J. C. N78-29756
N78-29757
GODBEY, L. C. N78-29610
GOELA, J. S. N78-29883
GOFF, S. N78-29817
GOLDSTEIN, G. N78-29594
GONIS, A. N78-29939
GORDON, L. H. N78-29577
GOREE, J. G. N78-29525
GORMAN, P. G. N78-29655
GOUDREAU, G. L. N78-29512
GOULD, J. N78-29811
GOULD, R. W. N78-29922
GRANT, G. C. N78-29733
GRAVES, C. W. N78-29199
GRAVES, L. K. N78-29858
GRAY, S. N78-29449
GRAY, S. P. N78-29365
GREEN, M. N78-29368

GREY, J. N78-29118
GRIFFIN, D. S. N78-29513
GRINBERG, J. N78-29956
GRISCOM, R. W. N78-29649
GROSSMAN, M. W. N78-29895
GROSSMAN, R. D. N78-29613
GRUBB, D. P. N78-29909
GRUBISIC, V. N78-29499
GRUNEWALD, O. N78-29553
GUISINGER, J. E. N78-29421
GUPTA, O. P. N78-29799

H

HABERCOM, G. E., JR. N78-29484
N78-29485
N78-29752
N78-29753
N78-29881
HACK, A. N78-29760
HACKER, M. P. N78-29923
HAFEZ, M. M. N78-29071
HAGIN, W. V. N78-29749
N78-29755
HAHN, H. T. N78-29152
HAHN, W. F. N78-29992
HAIBACH, E. N78-29501
N78-29504
HALLIDAY, R. A. N78-29531
HALME, L. N78-29354
HALPERN, I. P. N78-30009
HAMEETMAN, G. J. N78-29138
HAMMOND, C. F. N78-29191
HANEY, H. P. N78-29067
HANKEY, W. L., JR. N78-29414
HANOLD, R. J. N78-29547
HANRATTY, T. J. N78-29411
HANSEN, L. W. N78-29296
HANSON, D. W. N78-29334
HANYSIAK, W. M. N78-29241
HARDESTY, D. R. N78-29603
HARGRAVES, W. R. N78-29590
HARMAN, W. W. N78-29973
HARRISON, D. J. N78-29447
HARRISON, E. A. N78-29651
N78-29745
HARRISON, W. B. N78-29371
HART, D. A. N78-29314
HARVEY, R. W. N78-29923
HASCHKE, D. N78-29632
HASSELWANDER, G. B. N78-29278
HASTINGS, W. J. N78-29101
N78-29102
HATFIELD, R. B. N78-30007
HATZIAVRAMIDIS, D. T. N78-29411
HAUSER, J. R. N78-29585
HAWLEY, S. A. N78-30019
HAYES, J. R. B. N78-30005
HAYGOOD, R. C. N78-29755
HAYRE, H. S. N78-29302
HAYWARD, W. N78-29602
HAYWOOD, R. C. N78-29749
HECKMAN, E. J. N78-29921
HEFFLEY, R. K. N78-29699
HEIGHTLEY, J. D. N78-29378
HEIKKILA, W. J. N78-29691
HEILMAN, M. N78-29650
HEIM, N. F. N78-30003
HEIMBURGER, G. N78-29744
HEIMERAL, J. M. N78-29684
HEIMERL, J. M. N78-29682
HEIN, G. F. N78-29578
HEITZ, J. N78-29327
HELEN, D. M. N78-29989
HELLEDAY, E. N78-29264
HELLER, R. N78-29467
HELM, W. J. N78-29358
HEMSCH, M. J. N78-29070
HENDRICK, R. W., JR. N78-29324
HENNINGSEN, T. N78-29440
HENRY, R. C. N78-29625
HERAKOVICH N78-29503
HERLIN, M. A. N78-29374
HERRINGTON, S. S. N78-29749
N78-29755
HERRON, B. G. N78-29147
HERRON, L. W. N78-29948
HETRICK, M. A. N78-29146
HEUER, A. H. N78-29251
HEWITT, F. J. N78-29125
HEYDWEILLER, J. C. N78-29990
HEYMAN, J. S. N78-29871
HICKS, C. P. N78-29193
N78-29194
HICKS, H. G. N78-29442
HILL, R. A. N78-29603
HINCKS, J. A. N78-29254
HINRICHS, D. J. N78-30002
HIRSCH, K. N78-29445
N78-29446
HOCK, V. F., JR. N78-29222
HOCKER, R. G. N78-29457
HODGDON, R. B. N78-29574
HODGE, D. B. N78-29134
HODGE, J. K. N78-29307
HOFF, L. E. N78-29668
HOFFMAN, H. W. N78-29414
HOFFMAN, R. E. N78-29323
HOFMANN, D. J. N78-29576
HOLLER, F. J. N78-29153
HOLMAN, R. H. N78-29705
HOLMQUIST, K. W. N78-29172
HOLT, S. S. N78-29799
HOLZHAUER, E. N78-30018
HOMAN, R. A. N78-29446
HONG, S. H. N78-29352
HOPMAAKER, K. N78-29916
HOPPER, D. J. N78-29864
HORN, W. N78-29147
HORN, W. J. N78-29611
HORNSTEIN, J. V. N78-29111
HOWARD, C. J. N78-29164
HOY, H. H. N78-29685
HOY, J. M. N78-29060
HSIAO, D. K. N78-29053
HUANG, C. J. N78-29775
HUANG, K. T. N78-29820
HUANG, M. D. N78-29375
HUDLET, R. N78-29155
HUDSON, W. H. N78-29834
HUGHES, I. N78-29284
HUGHES, W. R. N78-29974
HUNDEMANN, A. S. N78-29621
N78-29266
N78-29267
HUNG, P. Q. N78-29551
HUSSEY, W. J. N78-29552
HWAN, R. N. N78-29615
HWANG, K. S. N78-29616
HYMAN, J. N78-29617
N78-29618
N78-29888
N78-29139
N78-29175
N78-29678
N78-29147

I

INGRAHAM, J. C. N78-29928
INGRAM, D. L. N78-29709
N78-29710
INOUE, S. N78-29913
IRWIN, C. L. N78-29824
IVANOV, V. V. N78-29535
IWAMOTO, R. N. N78-29646

J

JACKSON, R. H. F. N78-29866
JACOB, M. C. N78-29398
JACOBS, P. F. N78-29048
JACOBSON, I. D. N78-29076
JACOBSON, M. R. N78-30012
JACOCKS, J. L. N78-29876
JAFFE, R. L. N78-29149
JAHODA, F. C. N78-29927
JAMES, L. E. N78-29365
JANCAITIS, J. R. N78-29545
JASKE, C. E. N78-29234
JAY, A. N78-29105
JEFFERIES, K. N78-29994
JENDRZEJCZYK, J. A. N78-29510
JENSEN, T. H. N78-29921
JIRSA, J. O. N78-29278
JOCHIM, E. F. N78-29548
JOFFE, A. N78-29319
JOHANSSON, I. N78-29516
JOHNSON, D. L. N78-29352
N78-29698
JOHNSON, J. D. N78-29804
JOHNSON, R. A. N78-29834
JOHNSON, R. L. N78-29185
JOHNSON, S. N78-29553
JOHNSTON, J. F. N78-29051
JONES, B. E. V. N78-29731
N78-29732
JONES, T. J. N78-30013
JOSEPH, S. G. N78-29750
JUSTUS, C. G. N78-29590

K

KADALA, P. S. N78-29467
KADI, S. E. K. N78-29405
KAEPPELER, H. J. N78-29930
KAHANE, S. W. N78-29626
KAHN, M. L. N78-29360
KALUZIENSKI, L. J. N78-30018
KAMMEL, R. N78-29209
KAMP, J. L. M. N78-29157
KANDA, M. N78-29335
KANNEL, J. W. N78-29454
KARASALO, I. N78-29409
KARELIN, B. D. N78-29717
KARLSSON, T. N78-29265
KATAYAMA, H. N78-29423
KAUL, R. N78-29309
KAWAI, Y. N78-29912
KEDEM, G. N78-29786
N78-29831
KEDL, R. J. N78-29576
KEEFE, J. R. N78-29724
KEELIN, T. W., III N78-29713
KEEVER, C. P. N78-30007
KELLER, V. W. N78-29662
KELLEY, C. T. N78-29863
KELM, S. N78-29196
KEMP, E. L. N78-29282
N78-29283
KEMPE, E. E., JR. N78-29100
KENG, T. T. C. N78-29563
KENTON, E. N78-29114
KERLEY, G. I. N78-29804
KERMODE, R. I. N78-29273
KERSHAW, R. N78-29961
KEYSER, G. N78-29123
KHATTAK, M. N. N78-29652
KIESSLING, K. G. N78-29469
KIM, E. T. N78-29273
KIM, R. Y. N78-29152
KING, G. F. N78-29756
N78-29757
KING, W. F., III N78-29877
KIRCHHOFF, V. W. J. H. N78-29667
N78-29676
N78-29677
KIRILTSEV, V. T. N78-29401
KIRSTEN, F. A. N78-29998
KISLIN, B. N78-29904
KIWAMOTO, Y. N78-29672
KLEWE, H. J. N78-29425
KNAUB, D. N78-29131
KNIFFEN, D. A. N78-30035
KO, H. G. N78-29966
KOELBEL, H. N78-29581
KOGISO, K. N78-29912
KORN, R. K. N78-29771
KOSCIANOWSKA, L. N78-29648
KOSCIANOWSKI, J. R. N78-29648
KOUTS, H. J. C. N78-29898
KOWALSKI, S. H. N78-29325
KOZLOWSKI, H. N78-29867
N78-29868
N78-29869
KRAMER, W. H. N78-29103
KRETZ, F. N78-29298
KRISHNASWAMY, S. N78-29176
KRUCZEK, H. K. N78-29787
KRUMM, N. A. N78-30020
KUAN, T. S. N78-29955
KUKACKA, L. E. N78-29611
KUMAR, R. N78-29536
N78-29537
KUMMER, W. H. N78-29304
KURTZ, H. A. N78-29882

L

LABARGE, W. L. N78-29084
LABUS, J. N78-29341
LACHAMBRE, J. L. N78-29437
LAGADINOS, J. C. N78-29353
LAIRD, W. B. N78-29442
LAM, C. K. N78-29896
LAMBRIGHT, W. H. N78-30010
LAN, C. E. N78-29086
LANCE, R. H. N78-29511
LANE, R. W. N78-29439
LANGE, F. F. N78-29248
LAPWORTH, K. C. N78-29447
LAQUEY, R. N78-29674
LARDIS, A. E. N78-29726
LARRICK, B. F. N78-29587
LARSON, D. B. N78-29687
LARSSON, N. N78-29522
LAUSTERER, G. K. N78-29177
LAVIGNE, P. N78-29437
LAW, E. H. N78-29467
N78-29525
LAWRENCE, N. B. N78-29322
LAWRENSON, I. J. N78-29195
LECHTENBERG, T. A. N78-29226
LEE, F. C. N78-29350
LEE, H. C. N78-29211
LEE, R. A. N78-29873
LEHMAN, J. M. N78-29699
LEHMAN, M. E. N78-29619
LEHOCZKY, J. P. N78-29812
LEIB, K. G. N78-29906
LELE, S. G. N78-29370
LEMAIRE, J. F. N78-30023
LEMING, T. D. N78-29720
LEVINE, H. N78-29286
LEVY, R. B. N78-29596
LEWICKI, G. W. N78-29421
LI, S. S. N78-29568
LIBERATORE, A. N78-29382
N78-29856

LIBY, A. L. N78-29459
LIEBER, A. J. N78-29429
LIFSON, M. W. N78-29995
N78-29996
LIN, J. N78-29217
LIN, S. T. N78-29431
LINDSEY, C. N78-29674
LINECK, T. S. N78-30002
LINEMAN, D. M. N78-29219
LINNARSON, A. N78-29258
LIPPMANN, J. N78-29337
LITTMAN, F. E. N78-29649
LO, J. T. H. N78-29821
LO, K. N78-29278
LOCKHART, L. B., JR. N78-29154
LOHR, J. N78-29921
LONGUSKI, J. M. N78-30022
LOWNEY, J. R. N78-29361
LOZANO, P. A. N78-29801
LUCAS, G. G. N78-29259
LUDFORD, G. S. S. N78-29189
N78-29190
LUDWIG, G. O. N78-29917
LUGANNANI, R. N78-29323
LUMINI, F. N78-29382
LUO, F. C. N78-29368
LUXON, J. L. N78-29921
LYMAN, W. J. N78-29272
LYNCH, F. X. N78-29680

M

MA, Y. Y. N78-29565
MACCRACKEN, M. C. N78-29636
MACK, J. C. N78-29094
MACLANE, S. N78-29840
MADDALON, D. V. N78-29059
MADEJ, M. A. N78-29646
MAGNUSSON, G. L. N78-29986
MAHDAVI, A. N78-29921
MAHER, E. F. N78-29739
MAINIERO, R. J. N78-29178
MAKOSKY, F. N78-29711
MALIK, D. F. N78-29470
N78-29472
N78-29473
N78-29474
N78-29475
N78-29476
N78-29477
N78-29478
N78-29479
N78-29480
MALL, W. N78-29776
MANN, G. W. N78-29291
MANOLA, F. A. N78-29775
MARCUS, B. D. N78-29410
MARESCA, J. W., JR. N78-29702
MARGERUM, J. D. N78-29956
MARKS, R. J., II N78-29901
MARQUES, V. S. N78-29666
MARSH, S. F. N78-29191
MARTIN, C. T. N78-29377
MARTIN, I. M. N78-29670
MARTIN, S. J. N78-29165
MARTINI, P. R. N78-29540
MARZEC, C. J. N78-30014
MASSEY, J. L. N78-29318
MATHUR, K. N. N78-29179
MATSUI, E. S. N78-29247
MAU, D. N78-29985
MAY, J. T. N78-29197
MAYERLE, J. J. N78-29439
MAYHAN, J. T. N78-29326
MAYS, L. W. N78-29557
MAZHAR, Z. N78-29819
MAZZONI, G. N78-29856
MCCHESNEY, J. N78-29327
MCCLUSKEY, R. J. N78-29891
MCCOMAS, R. L. N78-29646
MCCOMBE, B. D. N78-29960
MCCONAHY, R. J. N78-29127
MCCREARY, J. J. N78-29654
MCCREIGHT, L. R. N78-29183
MCCULLOUGH, B. F. N78-29284
MCCULLOUGH, D. N78-29704
MCEWEN, H. E. N78-29784
MCGEEHAN, T. J. N78-29968
MCGHEE, K. H. N78-29284
MCGILL, R. N78-29776
MCINTIRE, D. D. N78-29814
MCKEEL, W. T., JR. N78-29285
MCKNIGHT, J. W. N78-29356
MCLAUGHLIN, J. N78-29776
MCLEOD, A. N78-29286
MCLEOD, M. J. N78-29191
MCLEVIGE, W. V. N78-29940
MCMILLAN, E. A. N78-29365
MCMORROW, D. R. N78-29321
MCQUILLAN, J. M. N78-29796
MCROY, C. P. N78-29729
MCWHORTER, A. L. N78-29374
MEAD, W. C. N78-29442
MEHROTRA, A. K. N78-29202
MEIJER, J. J. N78-29073
MEKHED, G. N. N78-29279
MELAMED, N. T. N78-29440
MELIN, J. W. N78-29289
MELLANDER, I. N78-29865
MELLOR, A. M. N78-29184
MELLOR, M. N78-29679
MELNGAILIS, I. N78-29907
MENDEL, J. M. N78-29826
MENDILLO, M. N78-29680
MENESES, P. R. N78-29540
MENG, P. R. N78-29100
MERAZZI, S. N78-29523
MEREZHKIN, V. G. N78-29924
MERRILL, W. C. N78-29566
MERRIMAN, R. E. N78-29815
MESSING, G. L. N78-29207
MEYER, W. L. N78-29107
MIAO, D. N78-29994
MIDDLEBROOK, R. D. N78-29351
MIDHA, A. N78-29448
MIGHDOLL, P. N78-29992
MILLER, E. K. N78-29379
MILLER, J. W. N78-29904
MILLER, K. N78-29077
MILLER, L. D. N78-29534
MILLER, L. J. N78-29956
MILLER, M. R. N78-29369
N78-29780
N78-29781
MILLER, R. L. N78-29091
MINTONYE, B. A. N78-29316
MIRZA, J. F. N78-29526
MITCHELL, J. C. N78-29471
N78-29475
MITCHELL, T. E. N78-29481
MITLID, P. N78-29251
MIYAZAWA, H. N78-29383
MODDEMAN, W. E. N78-29300
MOELIER, C. P. N78-29253
MOELLER, C. P. N78-29922
N78-29920
N78-29921
MOFFATT, M. E. N78-29974
MOLINA, J. F. N78-29166
MOLINARI, R. L. N78-29622
N78-29721
MONAHAN, G. M. N78-29656
MONTGOMERY, J. A., JR. N78-29393
MONTS, D. L. N78-29432
MOORE, H. F. N78-29273
MOORE, J. D. N78-29322
MOORE, W. R. N78-29545
MOORMAN, S. L. N78-29426
MORARI, M. N78-29162
MOREL-SEYTOUX, H. J. N78-29554
MORELLO, S. A. N78-29058
MORRIS, C. N78-29377
MORRIS, D. J. N78-30035
MORRIS, L. D. N78-29696
MORRIS, S. J. N78-29436
MORRISON, G. L. N78-29065
MORRISON, W. F., JR. N78-29885
MORTON, K. W. N78-29828
MOSER, K. H. N78-29779
MOSTOVOY, S. N78-29509
MOTARD, R. L. N78-29820
MUELLER-WESTERHOFF, U. T. N78-29439
MUENZER, H. N78-29569
MUKHERJEE, S. N78-29511
MULAC, A. J. N78-29603
MUNSON, W. B. N78-29313
MURATOV, Y. A. N78-29338
MURIN, C. J. N78-29654
MURMAN, E. M. N78-29071
MURTHY, S. N. B. N78-29088
MYAMOTO, S. N78-29732
MYER, G. D. N78-29956

N

NAGEL, A. L. N78-29064
NAGEL, D. J. N78-29212
NAKAGAWA, S. N78-29423
NAPIER, J. C. N78-29416
N78-29417
NAZZAL, A. N78-29439
NEIGHBORS, A. J. K. N78-29491
NELSON, E. O. N78-29649
NESSEL, J. N78-29985
NEUDECK, G. W. N78-29359
NEWBERY, D. M. G. N78-29599
NEYNABER, R. H. N78-29683
NG, L. S. N78-29998
NIELSEN, J. N. N78-29070
NILES, F. E. N78-29682
N78-29684
NILSSON, L. N78-29516
NOONAN, R. E. N78-29795
NOONE, M. J. N78-29252
NOVICK, R. N78-29539
NOVLAN, D. J. N78-29704
NOVOTNY, D. B. N78-29488
NUALCHAWEE, K. N78-29534
NUNES, G. S. D. S. N78-29700
NUNES, H. M. T. N78-29700

O

ODEN, L. L. N78-29198
ODUM, H. T. N78-29619
OESTREICHER, D. N78-29774
OHNUMA, T. N78-29915
OKAL, E. A. N78-29673
OKEEFE, R. D. N78-29980
OLIVER, P. N78-29798
OLIVIER, R. N78-29497
OMALLEY, R. E., JR. N78-29829
ONG, R. S. B. N78-29678
OPPENLAENDER, T. N78-29930
OPRIAN, C. A. N78-29849
N78-29852
ORBAN, S. N78-29243
ORTMAN, D. N78-29721
ORVOS, P. S. N78-29458
OTIS, G. N78-29437
OTTEN, L. J., III N78-29436
OVERTON, H. L. N78-29547

P

PACK, J. L. N78-29440
PACKMAN, A. B. N78-29867
N78-29868
N78-29869
PAGE, G. C. N78-29275
PAGOULATOS, A. N78-29553
PALLESEN, L. C. N78-29838
N78-29846
PALMEIRA, R. A. R. N78-30035
PANKO, R. A. N78-29180
PANTELL, K. N78-29450
PAPAGIANNIS, M. D. N78-30029
PAPANTONI-KAZAKOS, P. N78-29317
PARDUE, D. R. N78-29740
PARKER, C. E. G. N78-29167
PARKER, L. W. N78-29366
PARKER, R. L., JR. N78-29876
PARKIN, G. F. N78-29991
PARKINSON, B. A. N78-29158
PATHAK, P. N. N78-29124
PAUL, C. R. N78-29355
N78-29356
N78-29357
PAVLOV, I. M. N78-29279
PAZY, A. N78-29862
PELLOUX, R. M. N78-29221
PERKIN, B. R. N78-29050
PERKINS, R. B. N78-29443
PERSSON, A. N78-29463
PERSSON, L. N78-29751
PESOTCHINSKY, L. N78-29825
PETERSON, C. R. N78-29713
PETERSON, R. G. N78-29941
PHILLIPS, L. D. N78-29713
PHILLIPS, M. M. N78-30015
PHILLIPS, R. G. N78-29292
PICKRELL, R. L. N78-29566
PIERCE, B. L. N78-29106
PIETERSEN, O. B. M. N78-29331
PILOTY, H. N78-29305
PIMENTAL, K. D. N78-29637
PINIZZOTTO, R. F., JR. N78-29203
PINKERMAN, K. O. N78-29657
PINTO, R. N78-29319
PISACANE, V. L. N78-29127
PLANT, T. J. N78-29415
PLEE, S. L. N78-29184
PLICHON, C. N78-29257
POLING, D. A. N78-29942
POLLOCK, W. J. N78-29495
PONNAMPERUMA, C. A. N78-30026
POWELL, J. R. N78-29898
POWELL, R. G. N78-29872
N78-29873
PRAG, A. B. N78-29129
PREISWERK, P. R. N78-29145
PREKOPA, A. N78-29376
N78-29848
PRELEC, K. N78-29897
PRICE, J. P. N78-29045
PRIEDHORSKY, W. C. N78-30016
PROBST, H. B. N78-29246
PROSS, G. N78-29930
PRUSLIN, D. H. N78-29328
PRYOR, L. L. N78-29127

Q

QUINLAN, P. M. N78-29827
QUONG, R. N78-29609

R

RAE, W. J. N78-29412
RAHN, L. A. N78-29603
RAIKES, S. A. N78-29675
RAMANUJARAO, K. N78-30035
RAMSEY, H. R. N78-29754
RANDALL, A. N78-29553
RANEY, J. P. N78-29057
RANTANEN, R. O. N78-29146
RANZIERI, A. J. N78-29657
RAO, V. B. N78-29666
RASMUSSEN, P. G. N78-29078
RASSERBAWER, M. N78-29227
RATHER, J. D. G. N78-29117
RAUSCH, J. R. N78-29142
RAVELING, P. N78-29774
RAWAL, B. S. N78-29204
RAWLS, J. M. N78-29923
RAZOUK, L. R. N78-29359
REBER, D. C. N78-29823
REBERTUS, D. W. N78-29890
REED, W. E. N78-29332
N78-29333
N78-29384
N78-29385
N78-29386
N78-29387
N78-29388
N78-29389
N78-29390
N78-29391
N78-29392
REEDY, E. D., JR. N78-29606
REID, I. A. N78-29531
REIMHERR, G. W. N78-29486
N78-29487
N78-29978
N78-29987
REIN, J. E. N78-29191
REISCHL, R. N78-29446
REMATY, R. N78-30037
RENCH, W. E. N78-29711
RENES, J. J. N78-29853
RESCHKE, D. N78-29339
RESS, E. B. N78-29146
RHODY, B. N78-29529
RICE, R. W. N78-29905
RICH, E. I. N78-29533
RICHER, I. N78-29796
RICHTER, D. S. S. N78-29943
RICHTER, G. N78-29736
RICHTER, R. N78-29589
RIDLEY, W. I. N78-30028
RIEF, P. G. N78-29956
RIO, R. A. N78-29108
RIORDAN, J. C. N78-29921
RISEN, W. M., JR. N78-29187
RIZK, M. H. N78-29071
ROBINETT, J. L., JR. N78-29297
ROBINSON, L. N78-29803
ROBINSON, S. M. N78-29837
ROBLES P., J. M. N78-29719
ROEDER, H. N78-29340
ROEHRIG, H. N78-29582
ROENSCH, F. R. N78-29191
ROGERS, D. N78-29309
ROGERS, W. L. N78-29368
RONCO, P. G. N78-29756
N78-29757
ROOD, G. T. N78-29804
ROOD, S. A. N78-29982
ROOS, R. N78-29073
RORIVE, A. L. N78-29311
ROSE, J. G. N78-29559
ROSEN, E. C. N78-29796
ROSEN, J. M. N78-29705
ROSENBAUM, B. B. N78-29586
ROSENBERG, S. S. N78-29066
ROSS, J. A. N78-29584
ROSWELL, R. L. N78-29742
ROTHBARD, J. B. N78-29148
ROTTIG, W. N78-29581
ROTZOLL, R. N78-29402
ROUCH, K. E. N78-29492
ROZKUSZKA, K. P. N78-29240
RUBENSTEIN, A. H. N78-29980
RUBLOFF, G. W. N78-29894
RUDOV, V. S. N78-29180
RUECKLE, B. N78-29931
RUFFELL, D. E. N78-29281
RUGGE, H. R. N78-29137
RULIFSON, R. L. N78-29646
RUNHA, S. D. M. N78-29967
RUSCITTO, D. N78-29449
RUSSELL, J. H. N78-29198
RUTHERFORD, J. A. N78-29683
RUTLEDGE, J. E. N78-29946

S

SAAD, A. A. N78-29527
SAADAT, H. N78-29209
SAFAI, N. M. N78-29404
SALEMME, C. T. N78-29104
SALMIRS, S. N78-29058
SALO, E. O. N78-29646
SASS, D. S. N78-29510
SAUNDERS, R. C., III N78-29436
SCARLETT, W. R. N78-30034
SCARPACE, F. L. N78-29558
SCHAEFER, D. W. N78-29255
SCHAFER, R. E. N78-29365
SCHAIRER, L. A. N78-29635
SCHATZ, B. R. N78-29810
SCHILLING, H. D. N78-29569
SCHILLING, P. N78-29930
SCHMEE, J. N78-29482
SCHMELTEKOPF, A. L. N78-29685
SCHMIDT, D. A. N78-29184
SCHMIDT, E. M. N78-29788
SCHMIDT, H. N78-29930
N78-29931
SCHNEIDER, C. C., JR. N78-29844
SCHNUR, F. N78-29581
SCHOENMAN, R. L. N78-29050
SCHOFIELD, W. H. N78-29403
SCHOTT, J. N78-29779
SCHRA, L. N78-29518
SCHRAG, M. P. N78-29655
SCHRAUFNAGEL, R. A. N78-29181
SCHRECKENBERG, H. N78-29569
SCHROEDER, W. N78-29075
SCHUETZ, D. N78-29500
SCHULTZ, M. C. N78-29185
SCHULZ, H. N78-29581
SCHULZ, W. N78-29380
SCHWIRIAN, R. E. N78-29515
SCHWUTTKE, G. H. N78-29364
SCINTA, J. N78-29564
SEATON, A. F. N78-29304
SEBAUGH, J. L. N78-29855
SEEGMILLER, H. L. N78-29451
SEIDEL, D. C. N78-29197
SEPEHRONOORI, K. N78-29818
SERLEMITSOS, P. J. N78-30018
SHAFIQ, M. N78-29854
SHAKHATRE, M. N78-29930
SHANNON, D. W. N78-29612
SHANNON, L. J. N78-29655
SHAPIRO, L. N78-29985
SHARP, L. R. N78-29129
SHEA, M. A. N78-30030
SHEFFIELD, J. N78-29926
SHERBY, O. D. N78-29217
SHIBAYA, H. N78-29423
SHIEH, A. S. L. N78-29830
SHIN, Y. S. N78-29510
SHOEPFLIN, F. N78-29609
SHOOTER, D. N78-29272
SHORT, T. H. N78-29610
SIDDIQI, T. A. N78-29578
SIEGEL, E. N78-29341
SILLA, H. N78-29274
SILVA, L. F. N78-29537
SIMONICH, D. M. N78-29667
N78-29677
SINHA, B. K. N78-29957
SIPES, T. G. N78-29638
N78-29639
SIRMANS, D. N78-29714
SKOROBATCKYI, M. N78-29100
SLEEPER, R. K. N78-29056
SLETTEN, C. J. N78-29600
SLOB, W. H. N78-29430
SMARDZEWSKI, R. R. N78-29186
SMIT, J. N78-29762
SMITH, A. R., JR. N78-29789
SMITH, C. A. N78-29070
SMITH, C. B. N78-29859
SMITH, D. L. N78-29910
SMITH, J. J. N78-29103
SMITH, J. L. N78-29995
N78-29996
SMITH, L. G. N78-29665
SMITH, M. F. N78-29229
N78-29230
N78-29231
N78-29232
N78-29233
N78-29235
SMITH, P. D. N78-29708
SMITH, R. L. N78-29068
SMYTHE, D. S. N78-29956
SNIDER, L. D. N78-29841
SNOEYINK, V. L. N78-29654
SOKOLOV, D. V. N78-29279
SOLER, O. L. N78-29474
SOLFRIAN, W. N78-29632
SOLOMON, M. D. N78-29069
SOLOMON, R. N78-29988
SOLOW, D. N78-29797
SONDEREGGER, R. N78-29607
SOWUL, L. N78-29947
SPAITE, P. W. N78-29275
SPEAKMAN, J. D. N78-29872
N78-29873
SPECKHARD, M. E. N78-29737
SPIEKHOUT, D. J. N78-29096
SPINDEL, J. E. N78-29504
SPOONER, J. E. N78-29778
SPURGIN, N. D. N78-30007
STAMMREICH, J. R. N78-29145
STAMULIS, A. N78-29631
STAPLETON, R. E. N78-29368
STARKE, E. A., JR. N78-29220
STARON, R. J. N78-29799
STAUFFACHER, C. V. N78-29949
STECKEL, G. L. N78-29174
STEHLIN, P. N78-29523
STEINBERG, M. N78-29898
STEKETEE, J. A. N78-29419
STEPHENSON, J. L. N78-29406
STIGLITZ, J. E. N78-29599
STOFAN, P. E. N78-29733
STOLTZ, R. E. N78-29221
STOTZ, R. N78-29774
STOUT, N. D. N78-29609
STOVER, J. G. N78-29602
STOVER, R. F. N78-29808
STROM, R. G. N78-30025
STROPPEL, K. G. N78-29582
STUBBS, S. M. N78-29056
STUTZ, R. A. N78-29778
STUVE, J. M. N78-29966
STYGAR, P. N78-29773
SUBBARAO, S. N. N78-29961
SUGAMA, T. N78-29611
SUGAREK, R. L. N78-29638
N78-29639
SULANKE, H. N78-29299
SULIDI-KONDRATYEV, Y. D. N78-29535
SULLIVAN, R. H. N78-30008
SUMNER, I. E. N78-29407
SUNG, Y. K. N78-29244
SUTEAU, A. M. N78-29664
SVISCO, C. A. N78-29253
SWANTNER, W. H. N78-29899
SWARM, R. E. N78-29904
SYMES, W. N78-29832
N78-29833
SZABLEWICZ, M. N78-29648

T

TAKAGI, S. N78-29686
TAKAHASHI, H. N78-29898
TAKATA, A. N. N78-29738
TANEJA, V. S. N78-29851
N78-29852
TANNER, J. E., JR. N78-29727
TANTRAPORN, W. N78-29800
TAVIS, R. L. N78-29289
TAWFIK, M. E. N78-29526
TAYLOR, A. B. N78-29049
N78-29052
TAYLOR, E. N78-29112
TAYLOR, G. R. N78-29725
TAYLOR, J. G. N78-29608
TEIXEIRA, J. R. N78-29792
TERHUNE, R. W. N78-29688
TERRY, J. G. N78-29090
TESSARZIK, J. N78-29108
TEW, R. N78-29994
THAPLIYAL, H. V. N78-29200
THEOBOLD, D. M. N78-29134
N78-29668
THOMAS, D. C. N78-29109
THOMAS, K. N78-29513
THOMAS, R. L. N78-29575
THOMPSON, B. N78-29776
THOMPSON, C. W. N. N78-29980
THOMPSON, P. A., JR. N78-29720
THOMPSON, R. E. N78-29106
THOMPSON, W. N78-30008
THORN, D. L. N78-29201
THUOT, M. E. N78-29777
TICE, J. J., IV N78-29159
TIDWELL, D. N78-29721
TIERSTEN, H. F. N78-29957
TIJDEMAN, H. N78-29074
TIMS, A. C. N78-29874
TIRPAK, D. N78-29971
TODD, E. S. N78-29105
TOLAND, R. H. N78-29605
TOM, C. N78-29534
TORREGIANI, V. G. N78-29072
TRAEGAARDH, C. N78-29692
TRICOT, R. N78-29218
TRUJILLO, A. N78-29760
TRUNK, M. N78-29930
TUCKER, C. J. N78-29544
TULINTSEFF, N. G. N78-29701
TULL, S. E. N78-30036
TUMMINELLI, S. C. N78-29496
TUNG, S. S. N78-29400
TUNG, Y. K. N78-29557
TUTEN, J. M. N78-29467
TVELIGDAN, J. T. N78-29440
TWOMEY, R. C. N78-29372
TZINIS, C. T. N78-29187

U

UCHIDA, T. N78-29914
ULBRICH, E. N78-29305
UPPALURI, B. R. N78-29081
URIE, D. M. N78-29051
UTAH, D. A. N78-29234

V

VAFAEI-MAKHSOOS, E. E. N78-29208
VALENTINE, J. R. N78-29272
VALID, R. N78-29524
VANCE, B. N78-29680
VANDERMEER, C. N78-29743
VANDREUMEL, W. H. M. N78-29157
VANLEEUWEN, H. P. N78-29518
VANNUNEN, J. W. G. N78-29073
VANTHOF, J. N78-29635
VASLOW, D. F. N78-29921
VAUGHAN, J. A. N78-29078
VAUGHAN, W. W. N78-29669
VEDESHIN, L. A. N78-29535
VENEZIANI, P. N78-29540
VERONDA, C. N78-29079
VERSCHOOR, J. D. N78-29277
VEST, R. W. N78-29958
VIECHNICKI, D. J. N78-29959
VIEZEE, W. N78-29703
VILLENEUVE, A. T. N78-29304
VINH, N. X. N78-30022
VIRDEE, M. S. N78-29517
VITALE, R. A. N78-29861
VOGELSANG, K. R. N78-29117
VONDIEST, G. N78-29582
VONHELLERMANN, M. N78-29445
VOSS, D. A. N78-29849
N78-29852
VOSS, H. D. N78-29665
VROOM, D. A. N78-29683

W

WAGGONER, E. G. N78-29067
WAGNER, R. G. N78-29889
WALTERS, W. C. N78-29464
WANG, E. E. N78-29185
WANG, F. C. N78-29619
WANG, M. C. N78-29284
WANG, O. S. L. N78-29399
WANGENHEIM, H. N78-29350
WANHILL, R. J. H. N78-29483
WARD, M. E. N78-29416
N78-29417
WARD, W. N78-29077
WARREN, D. N78-29350
WARSHAW, H. N78-29674
WATERS, K. T. N78-29083
WEAVER, H. L. N78-29981
WEAVER, J. N78-29714
WECKSUNG, G. W. N78-29546
WEEKS, M. H. N78-29741
WEEKS, S. J. N78-29160
WEEKS, W. F. N78-29679
WEFER, F. L. N78-30029
WEGMAN, E. J. N78-29811
WEI, C. Y. N78-29213
WEIDLICH, E. N78-29736
WELEBIR, A. N78-29997
WELLCK, R. E. N78-29697
WELLFORD, L. C. N78-29071
WELSH, K. W. N78-29078
WENDT, U. N78-29498
N78-29501
N78-29319
WENG, L. J. N78-29736
WENZEL, M. N78-29601
WERNER, D. N78-29150
WEST, R. N78-29763
WEWERINKE, P. H. N78-29368
WEY, H. Y. N78-29664
WHITCOMB, J. H. N78-29799
WHITE, D. D. N78-29965
WHITEWAY, R. N. N78-29870
WHITFIELD, C. E. N78-29951
WHITFIELD, R. G. N78-29652
WHITMORE, F. C. N78-29751
WIDEN, H. N78-29572
WIESENMAIER, B. L. N78-29282
WILHELM, W. J. N78-29283
N78-29378
WILLIAMS, J. D. N78-29060
WILLIAMS, L. J. N78-29061
N78-29735
WILLIAMS, R. A. N78-29706
WILLIAMS, R. T. N78-29147
WILLIAMSON, W. S. N78-29747
WILLIS, C. A. N78-29754
WILLOUGHBY, J. K. N78-29352
WILSON, D. D. N78-29835
WILSON, J. N78-29627
WILSON, J. C. N78-29143
WILSON, S. W. N78-29900
WINKLER, C. E. N78-29918
WINSOR, N. N78-29932
WIRTH, F. H. N78-29099
WISLER, D. C. N78-29063
WITCOFSKI, R. D. N78-29156
WITHERELL, C. E. N78-29325
WITT, J. H. N78-29253
WITTBERG, T. N. N78-29084
WITTLIN, G. N78-29906
WOHLERS, M. R. N78-29173
WOLCOTT, H. A. N78-29961
WOLD, A. N78-29703
WOLF, D. E. N78-29539
WOLFF, R. S. N78-29363
WOLKOFF, E. N78-29582
WOLOWSKI, E. N78-29395
WON, Y. S. N78-29772
WONG, Y. C. A. N78-29860
WOO, M. H. N78-29584
WOOLDRIDGE, G. A. N78-29928
WRIGHT, B. L. N78-29250
WROBLESKI, J. T. N78-29886
WU, J. T. N78-29952
WU, S. D.

Y

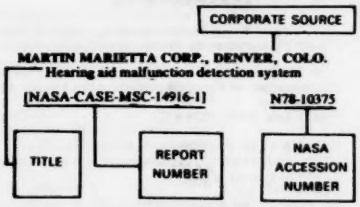
YAJIMA, N. N78-29912
YAMAGISHI, F. G. N78-29956
YAMANOUCHI, S. N78-29342
YAMAZAKI, K. N78-29914
YANG, H. T. N78-29953
YANG, K. N78-29950
YANG, K. H. N78-29364
YERAZUNIS, S. N78-29131
N78-29132
YIONOULIS, S. M. N78-29127
YOKEL, S. A. N78-29104
YOKOYAMA, K. N78-29423
YOO, J. Y. N78-29394
YOSHIKAWA, S. N78-29954
YOUNG, D. A. N78-29225
YOUNG, M. E. N78-29977
YOUNG, V. F. N78-29352
YU, K. H. A. N78-29528
YU, M. T. N78-29493
YU, S. P. N78-29800
YU, Y. N78-29350
YUN, Y. H. N78-29961

Z

ZAFFLE, J. N78-30008
ZAKANYCZ, P. N78-29312
ZALOGUEV, S. N. N78-29725
ZAPLATYNSKY, I. N78-29216
ZEIDERS, G. W. N78-29117
ZELDIN, A. N78-29611
ZICKEFOOSE, C. N78-30004
N78-30005
ZIEMAN, J. C. N78-29729
ZINN, B. N78-29107
ZOLLWEG, R. J. N78-29440
ZORNIG, H. F. N78-29610
ZUCCHETTO, J. N78-29985
ZUGARO, F. A. N78-29454

CORPORATE SOURCE INDEX

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

AEROJET ELECTROSYSTEMS CO., AZUSA, CALIF.
Integrated thin-film transistor display
[AD-A053627] N78-29358

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Wear tests with PTFE-bearings at varying loads
[FFA-TN-HU-1755] N78-29462
Fatigue testing of transversely loaded aluminium lugs, sequence 2
[FFA-TN-HU-1848] N78-29522
Viscoelastic buckling of shells
[FFA-TN-HU-1911] N78-29523

AERONAUTICAL RESEARCH LABS., MELBOURNE (AUSTRALIA).
The response of turbulent shear flows to discontinuous changes in surface roughness
[ARL/MECH-ENG-REPT-150] N78-29403
Design and testing of a small feedwater pump
[AD-A053646] N78-29453
An ultrasonic pulse-height difference method of recording crack growth over an extended period
[ARL/MAT-NOTE-120] N78-29495

AEROSPACE CORP., EL SEGUNDO, CALIF.
The construction of thermospheric density correction tables for use in satellite trajectory and lifetime predictions
[AD-A054341] N78-29129
Compilation of scientific results from the satellite OVI-17
[AD-A050483] N78-29137

AEROSPACE MEDICAL RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
Community noise exposure resulting from aircraft operations. Volume 1: Acoustic data on military aircraft
[AD-A053699] N78-29872
Community noise exposure resulting from aircraft operations. Volume 4: Acoustic data on Air Force trainer/fighter aircraft
[AD-A053702] N78-29873

AGENCY FOR INTERNATIONAL DEVELOPMENT, WASHINGTON, D.C.
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information
[PB-279193/7] N78-29981

AIR FORCE AERO PROPULSION LAB., WRIGHT-PATTERSON AFB, OHIO.
Aircraft hazard detection and control utilizing an aircraft data acquisition system
[AD-A054416] N78-29092
Hydrogen content of hydrocarbon fuels by a low-resolution nuclear resonance method
[AD-A054465] N78-29262

AIR FORCE FLIGHT DYNAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Digital simulation of flexible aircraft response to symmetrical and asymmetrical runway roughness
[AD-A053588] N78-29087
An exact velocity potential solution of steady, compressible flow over arbitrary two-dimensional and axisymmetric bodies in simply connected fields
[AD-A054462] N78-29415

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
Estimates from satellites of weather erosion parameters for reentry systems
[AD-A053654] N78-29136
Solar terrestrial physics data exchange
[AD-A054101] N78-30030

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Improving aided track performance during periods of tracker sensor failure by utilizing a target body fixed coordinate system
[AD-A053445] N78-29090
The design of an optimum alphanumeric symbol set for cockpit displays
[AD-A053447] N78-29097
Quantitative processing of signal space data to provide transmission line analysis
[AD-A053444] N78-29316

AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO.
Swelling of composite laminates
[AD-A053742] N78-29152

AIR FORCE PACKAGING EVALUATION AGENCY, WRIGHT-PATTERSON AFB, OHIO.
Water vapor permeability of plastic fast packs
[AD-A054509] N78-29254

AIR POLLUTION TECHNOLOGY, INC., SAN DIEGO, CALIF.
Evaluation of three industrial particulate scrubbers
[PB-279572/2] N78-29656

AIR TRAINING COMMAND, RANDOLPH AFB, TEX.
Alternatives for future undergraduate pilot training
[AD-A053374] N78-29750

AIR WAR COLL., MAXWELL AFB, ALA.
An examination of the weather graphics system [digital facsimile] acquisition
[AD-A053567] N78-29701

ALABAMA UNIV., UNIVERSITY.
Dynamic response of a geometrically non-linear elastic/viscoelastic cylinder
N78-29491
Interactive computer methods for calculating geometrical and inertial properties of general shaped areas and volumes of revolution
N78-29764
Regular transformation groups and homomorphisms
N78-29860
Primary aberrations for grazing incidence
N78-29900
Thermoluminescence and electron spin resonance studies of irradiated biological single crystals
N78-29935

AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, NEW YORK.
A critical review of the state of foreign space technology
[NASA-CR-157363] N78-29118

AMERICAN PUBLIC WORKS ASSOCIATION, CHICAGO, ILL.
Sewer system evaluation, rehabilitation and new construction; a manual of practice
[PB-279248/9] N78-30008

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, NEW YORK.
ASME report on pipeline system safety
[PB-279330/5] N78-29288

AMERICAN UNIV., WASHINGTON, D. C.
Evaluation of high performance liquid chromatography packings for the concentration and separation of organic materials in water
[AD-A053652] N78-29997

ANDOVER CONTROL CORP., MASS.
Installation package for integrated programmable electronic controller and hydronic subsystem - solar heating and cooling
[NASA-CR-150747] N78-29580

ANALYTICAL SERVICES CO., ELKINS PARK, PA.
Dynamic model for computer control of the extrusion of solid dielectric cable
[EPRI-EL-605] N78-29381

APPLIED PHYSICS LAB., JOHNS HOPKINS UNIV., LAUREL, MD.
The GEOS-3 orbit determination investigation
[NASA-CR-141441] N78-29127
Computer simulation of the effect of road roughness on tire-pavement forces in braking and cornering
[PB-279887/4] N78-29466

ARGONNE NATIONAL LAB., ILL.
Vibro-impact responses of a tube with tube-baffle interaction
[ANL-CT-78-11] N78-29510

ARINC RESEARCH CORP., ANNAPOLIS, MD.
Avionics planning guidance: Executive summary
[AD-A054719] N78-29098
SHF terminal/antenna study, tasks 7 and 8
[AD-A054703] N78-29325

ARIZONA STATE UNIV., TEMPE.
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525
Verbal prescriptive rules in cognitive pretraining for the vertical S-A training maneuver
[AD-A050971] N78-29749
Measuring pilot proficiency on an instrument training maneuver
[AD-A050972] N78-29755

ARIZONA UNIV., TUCSON.
Investigating mapping techniques for elucidating processes occurring in pyrotechnic flames and their flame analogs
[AD-A053373] N78-29260
Singular perturbations, order reduction, and decoupling of large scale systems
[AD-A054483] N78-29829
Optical design of a coherent optical processor
N78-29899
Use of operator equation of motion techniques in treating collective excitations
N78-29942
Appropriate technology for natural resources development: An overview, annotated bibliography, and a guide to sources of information
[PB-279193/7] N78-29981

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, ABERDEEN PROVING GROUND, MD.
Molecular beam sampling mass spectrometry of high heating rate of HMX in a polyurethane binder
[AD-A054328] N78-29249
Proposed design for a differential pressure gage to measure dynamic pressure in blast waves
[AD-A054372] N78-29427
BENCHMARK-76: Model computations for disturbed atmospheric conditions. 3: Results for selected excitation parameters at 60 km
[AD-A054376] N78-29682
BENCHMARK-76: Model computations for disturbed atmospheric conditions II. Results for the stratosphere and mesosphere
[AD-A054325] N78-29684

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, MOFFETT FIELD, CALIF.
Wind tunnel investigation of computationally optimized variable camber wing configurations
[NASA-TM-78479] N78-29067

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, ST. LOUIS, MO.
An experimental investigation of hingeless helicopter rotor-body stability in hover
[NASA-TM-78489] N78-29044
Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068

ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
Some elements of iceberg technology
[AD-A053431] N78-29679
In-plane deformation of non-coaxial plastic soil
[AD-A054217] N78-29686
Neutralization of organic substances in waste water by plants
[AD-A053435] N78-29728

ARMY ELECTRONICS COMMAND, WHITE SANDS MISSILE RANGE, N. MEX.
Atmospheric structure White Sands Missile Range, New Mexico. Part 6: 25-65 kilometers
[AD-A053568] N78-29704

ARMY ELECTRONICS TECHNOLOGY AND DEVICES LAB., FORT MONMOUTH, N. J.
Thermal cycle testing of 7-segment light emitting diodes [LED] displays. [Test Evaluation]
[AD-A054418] N78-29369
ARMY ENGINEER TOPOGRAPHIC LABS., FORT BELVOIR, VA.
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] N78-29545
ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Airfield pavement smoothness requirements
[AD-A050921] N78-29111
ARMY ENVIRONMENTAL HYGIENE AGENCY, ABERDEEN PROVING GROUND, MD.
Topical hazard evaluation program of candidate insect repellent AI3-36331, US Department of Agriculture propriety compound
[AD-A054216] N78-29741
ARMY MATERIALS AND MECHANICS RESEARCH CENTER, WATERTOWN, MASS.
Effect of spot and stud welding on ESR 4340 steel armor
[AD-A054025] N78-29455
Automatic control of weld penetration
[AD-A054026] N78-29456
Solid state formation of Nd:Y sub 3 Al sub 5 O sub 12 Nd YAG
[AD-A054428] N78-29959
ARMY MISSILE RESEARCH AND DEVELOPMENT COMMAND, REDSTONE ARSENAL, ALA.
Tradeoff of hardware and signal-to-noise ratio in moving target indicators
[AD-A054727] N78-29322
ARMY TEST AND EVALUATION COMMAND, ABERDEEN PROVING GROUND, MD.
Aircraft military utility and functional tests
[AD-A053617] N78-29091
ARO, INC., ARNOLD AIR FORCE STATION, TENN.
Suppression of perforated wall in a transonic wind tunnel and the effects on aerodynamic data
[AD-A054417] N78-29876
ASSOCIATION OF AMERICAN RAILROADS, CHICAGO, ILL.
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525
ASTRO RESEARCH CORP., CARPINTERIA, CALIF.
Extravehicular activity translation arm [EVATA] study
[NASA-CR-151755] N78-29145
ATOMICS INTERNATIONAL DIV., RICHLAND, WASH.
Determination of particle size distribution of salt crystals in aqueous slurries
[RHO-SA-5] N78-29192
ATOMICS INTERNATIONAL, GOLDEN, COLO.
Electron-beam fusion welding of beryllium
[RFP-2621] N78-29459

B

BARNES ENGINEERING CO., WALTHAM, MASS.
Advanced Multispectral Scanner [AMS] study
[NASA-CR-151753] N78-29424
BATTELLE COLUMBUS LABS., OHIO.
Investigating localized corrosion and sputtering feasibility of amorphous chromium-containing alloys
[AD-A053581] N78-29219
Corrosion fatigue of cast propeller alloys in flowing seawater
[PB-279337/0] N78-29234
The role of temperature in EHD
[AD-A054320] N78-29454
Space life sciences pilot user development program for the midwest region
[NASA-CR-151819] N78-29723
The visibility and impact of electronic storage and delivery of handbook-type information. Volume 1, part 1: Chapters 1-4. Part 2: Chapters 5 and appendices
[PB-278072/4] N78-29976
BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Brine chemistry and combined heat/mass transfer, volume I
[EPRI-ER-635-VOL-1] N78-29612
BAYLOR UNIV., HOUSTON, TEX.
The structure of amorphous hydrous erbium oxide gels
N78-29173
BECHTEL CORP., SAN FRANCISCO, CALIF.
Rapid transit subways: Guidelines for engineering new installations for reduced maintenance
[PB-279453/5] N78-30006
BENDIX CORP., SOUTH BEND, IND.
Fluidic pressure ratio sensor
[AD-A054464] N78-29109
BERGBAU-FORSCHUNG G.M.B.H., ESSEN [WEST GERMANY].
Evaluation of a data base for a 100 MW coal burning power using pressurized fluidized bed combustion
[BMFT-FB-T-77-48] N78-29569
BETA INDUSTRIES, INC., DAYTON, OHIO.
Infrared radiometer for measuring thermophysical properties of wind tunnel models
[NASA-CR-158898] N78-29426
BETTIS ATOMIC POWER LAB., WEST MIFFLIN, PA.
Hydraulic pressure pulses with elastic and plastic structural flexibility: Test and analysis [LWBR development program]
[WAPD-TM-1375] N78-29515
BLALOCK [S. D., JR.], KINGSPORT, TENN.
Structure of magnetic field perturbations during the development of unsteady separation in the Tokamak-6 installation
[ORNL-TR-4528] N78-29924
BOEING AEROSPACE CO., SEATTLE, WASH.
Propulsion/flight control integration technology [PROFIT] design analysis status
[NASA-CR-144875] N78-29101
Propulsion/flight control integration technology [PROFIT] software system definition
[NASA-CR-144876] N78-29102
Solar power satellite system definition study. Part 3: Preferred concept system definition
[NASA-CR-151746] N78-29133
BOEING COMMERCIAL AIRPLANE CO., SEATTLE, WASH.
Application of winglets and/or wing tip extensions with active load control on the Boeing 747
N78-29050
Active controls technology to maximize structural efficiency
N78-29053
BOEING VERTOL CO., PHILADELPHIA, PA.
Research requirements to reduce civil helicopter life cycle cost
[NASA-CR-145379] N78-29082
Civil helicopter design and operational requirement
[NASA-CR-145377] N78-29083
Heavy lift helicopter - advanced technology component program - rotor blade
[AD-A053423] N78-29089
HLH drive system
[AD-A054024] N78-29094
BOLT, BERANEK, AND NEWMAN, INC., CAMBRIDGE, MASS.
ARPANET routing algorithm improvements
[AD-A053450] N78-29796
BOOZ-ALLEN AND HAMILTON, INC., CLEVELAND, OHIO.
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135341] N78-29992
BOSTON UNIV., MASS.
Investigation of the triplet states of chlorophylls
[COO-2570-3] N78-29151
Numerical simulation of ionospheric and plasmaspheric dynamics
[AD-A053451] N78-29680
The radio spectrum of coronal hole 1
[AD-A051138] N78-30029
BRITISH LIBRARY LENDING DIV., BOSTON SPA [ENGLAND].
Investigating aerodynamic transverse forces in labyrinth seals in cases involving rotor eccentricity
[BLL-CE-TRANS-7083-[9022.09]] N78-29066
Solubility of hydrogen chloride and the kinetics of degradation of polyvinyl chloride
[BLL-PO-TRANS-3558-[7737.47]] N78-29180
Adhesion of electrolytic zine to aluminum cathodes
[BLL-RTS-10973] N78-29209
Adhesion of gold in ultra-high vacuum
[BLL-PO-TRANS-3555-[7737.47]] N78-29210
Study of the ageing effects of styrene copolymers
[BLL-PO-TRANS-3502-[7737.47]] N78-29242
Testing the stability of high-density polyethylene
[BLL-PO-TRANS-3564-[7737.47]] N78-29243
Impairment of picture signals and subjective quality in digital coding: Edge business visibility
[BLL-PO-TRANS-3516-[7737.47]] N78-29298
The influence of transmission system on subjective picture quality
[BLL-PO-TRANS-3541-[7737.47]] N78-29299
On calculation of alternating current switching processes and pulse distortion in narrowband systems
[BLL-RTS-10557] N78-29337
On the width of the commutation zone of direct current electrical machines with smooth-core armatures
[BLL-RTS-10633] N78-29338
Modelling the static current-voltage functions of transistors on analogue computers, with reference to the GF 126 transistor as an example
[BLL-RTS-10955] N78-29339
A new method of detecting defects in electronic devices
[BLL-PO-TRANS-3553-[7737.47]] N78-29340
The apparent resistance of aerials
[BLL-PO-TRANS-3538-[7737.47]] N78-29341
Laws for the structure of turbulence of axisymmetrical jets in an accompanying current
[BLLD-M-25563-[5828.4F]] N78-29401
Investigation on a slow running centrifugal pump at different Reynolds numbers
[BLL-RTS-10585] N78-29402
Dispersive and nondispersive analysis: Comparison of the two techniques used in microanalysis by means of an electron microprobe
[BLL-PO-TRANS-3531-[7737.47]] N78-29422
Accelerated reliability tests on electronic components and equipment
[BLL-PO-TRANS-3557-[7737.47]] N78-29469
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] N78-29529
Variability of water temperature in the Atlantic near the equator
[BLLD-M-24959-[5828.4F]] N78-29717
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Program PRESTO: Preparation of reference energy systems through time
[BNL-50723] N78-29594
Alternate materials of construction for geothermal applications
[BNL-50751] N78-29611
Tradescantia stamen hair: An introduction to the system and its use as a monitor atmospheric pollutants
[BNL-23829] N78-29635
Plasma neutralizer for H- beams
[BNL-23650] N78-29895
Neutralization of H[-] beams with gas jets
[BNL-23648] N78-29896
Development of H[-] sources at Brookhaven National Laboratory
[BNL-23651] N78-29897
Linear accelerator driven [LADR] and regenerative reactors [LARR] for nuclear non-proliferation
[BNL-50731] N78-29898
BROOKINGS INSTITUTION, WASHINGTON, D. C.
The interdependence of nations: An agenda for research
[PB-279472/5] N78-29988
BROWN UNIV., PROVIDENCE, R. I.
Sample modulated Raman spectroscopy and frequency modulated visible light: Resonance Raman spectrum of a polydiacetylene fiber
[AD-A054674] N78-29187
The hardness and deformation of tungsten carbide-cobalt alloys
N78-29211
A finite difference technique for solving optimization problems governed by linear functional differential equations
[AD-A053738] N78-29823
Codimension one isometric immersions between Lorentz spaces
N78-29858
Kinetic description of interaction of radiation with two- and three-level molecular systems
N78-29883
The chemisorption of carbon monoxide, carbon dioxide and oxygen on the MO[100] surface
N78-29936
The electrical and optical properties of the system TiO[2-x]. The electrical, optical and photoconducting properties of Fe[2-x]Cr[x]Ob [o less than or equal to x less than or equal to 0.047]
[AD-A053858] N78-29961
BUREAU OF MINES, ALBANY, OREG.
Methanation activity of Raney nickel catalysts: Effect of proportion of NiA Al3 and Ni2Al3 in precursor alloys
[PB-279656/3] N78-29198
Thermal dynamic properties of NiBr2 and NiSO4 from 10 to 1,200 K
[PB-279646/4] N78-29966
BUREAU OF MINES, SALT LAKE CITY, UTAH.
Dehydrating magnesium chloride by double salt-salt decomposition
[PB-279653/0] N78-29197

C

CALIFORNIA INST. OF TECH., PASADENA.
Experimental studies of interfacial electro chemistry
N78-29158
Some investigations in theoretical and experimental electrochemistry
N78-29170
Modelling, analyses and design of switching converters
[NASA-CR-135174] N78-29351
A local earthquake coda magnitude and its relation to duration, moment M sub O, and local Richter magnitude M sub L
[NASA-CR-157473] N78-29664

Application of normal mode theory to seismic source and structure problems: Seismic investigations of upper mantle lateral heterogeneity
[NASA-CR-157354] N78-29673
Regional variations in upper mantle compressional velocities beneath southern California 1. Post-shock temperatures: Their experimental determination, calculation, and implications, 2.
N78-29675
The processing of velocity information by the pursuit oculomotor system
N78-29735
Part 1: A recirculating charge-coupled device. Part 2: The mercury selenide on N-silicon Schottky barrier
N78-29933
Observations of three binary X-ray sources: CYG X-1, CYG X-2, and 4U1813+50 [AM HER]
N78-30016
Infrared studies of two dark clouds
N78-30017

CALIFORNIA STATE DEPT. OF TRANSPORTATION, SACRAMENTO.
Analysis of full depth AC pavements using layered elastic theory
[PB-279386/7] N78-29291
Air pollution and roadway location, design and operation project overview
[PB-279395/8] N78-29657

CALIFORNIA UNIV., BERKELEY.
Research of microwave scattering properties of snow fields
[NASA-CR-157472] N78-29303

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Thermodynamic properties of SeS
[LBL-6994] N78-29155
Comparison of the microstructure and mechanical properties of 300-M steel manufactured by the vacuum arc remelt and the electroslag remelt processes
[LBL-6686] N78-29226
Mathematical and computational studies of equilibrium capillary free surfaces
[NASA-CR-135345] N78-29408
Mathematical and computational studies of the stability of axisymmetric annular capillary free surfaces
[NASA-CR-135346] N78-29409
Diagnostic tests determining the thermal response of a house
[LBL-6856] N78-29607

CALIFORNIA UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Inductive power coupling for an electric highway system
[LBL-7262] N78-29998

CALIFORNIA UNIV., DAVIS.
California Water Resources Center
[PB-279614/2] N78-29555

CALIFORNIA UNIV., LIVERMORE.
Survey of models to predict the effect of geothermal power development on domestic water supplies and to design pollution monitoring methods
[UCRL-79977] N78-29637

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
Diffusion welding multifilament superconductive composites
[UCRL-80436] N78-29156
Soft-sphere model for liquid metals
[UCRL-52352] N78-29225
Analyzing X-ray valence band spectra by mathematical methods. Discussion and investigation of noise reduction, differentiation and deconvolution of spectra
[UCRL-TRANS-11326] N78-29227
Electronics engineering research proposals for FY78
[UCID-17711] N78-29379
Radio chemistry as a diagnostic in laser fusion experiments
[UCRL-79778] N78-29442
Computer module for one step dynamic response of an axisymmetric or plane linear elastic thin shell
[UCID-17730] N78-29512
Current status of composite flywheel development
[UCRL-80604] N78-29605
Conditioning of geothermal brine effluents for injection: Use of coagulants
[UCID-17716] N78-29609
Representative industrial solar energy installation, Northridge Hospital, Northridge, California
[UCRL-13789] N78-29613
Studies of air pollution effects on vegetation
[UCID-17714] N78-29634
MAP3S: Studying the transport, transformation, and fate of atmospheric energy-related pollutants. Addendum: Projected listings for FY 1977
[DOE/EV-0008/2] N78-29636
Plane shock wave studies of geologic media
[UCRL-52357] N78-29687
Estimate of earth media shear strength at the Nevada Test Site
[UCRL-52358] N78-29688
Tomography of laser fusion plasmas
[UCRL-79291] N78-29925

CALIFORNIA UNIV., LOS ANGELES.
High temperature irradiation damage in nickel-chromium solid solutions
N78-29203
Hierarchical organization of distributed packet-switching communication systems
N78-29295
Experimental study of gas absorption into turbulent falling films of low surface tension liquids
N78-29395
Focused laser beam scattering by stationary and moving particles: A theoretical study
N78-29433
The air quality and oil spill implications of Alaskan oil importation into Southern California
N78-29626
Aggregation theory and its application to modeling in mathematical programming
[AD-A054061] N78-29802
Peak load pricing of computer network services
N78-29806
Advances in filtering techniques for stochastic systems with uncertain parameters, part I
[AD-A054396] N78-29844
Phenomenology of neutral current interactions
N78-29888
Techniques of macromolecular crystallography
N78-29949

CALIFORNIA UNIV., SAN DIEGO.
Study of shoaling waves in the laboratory
N78-29716
The application of convex regularization to Tchebycheff systems
N78-29859

CALIFORNIA UNIV., SANTA CRUZ.
Critical behavior of Reggeon field theory on a lattice
N78-29944
Observations and analysis of Fe 2 emission in Seyfert 1 galaxies and QSOs
N78-30015
The chemical composition of galactic and extragalactic H II regions
N78-30019

CALMAC MFG. CO., ENGLEWOOD, N. J.
Design and installation package for a solar powered pump
[NASA-CR-150740] N78-29570

CALSPAN CORP., BUFFALO, N. Y.
Computer program for relaxation solutions of the nonlinear small disturbance equations for transonic flow in an axial compressor blade row
[AD-A053744] N78-29412

CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
A mechanism for ultralow interfacial tension in systems containing microemulsions: Theoretical considerations and experiments with ultracentrifuge
N78-29175
The kinetics of two-phase emulsion polymerization
N78-29236
Word hypothesization for large-vocabulary speech understanding systems
N78-29789
The application of diffusion approximations to the study of time-sharing computers and transitory queueing systems
[AD-A054313] N78-29812

CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Metastable diamond synthesis and the rate of carbon formation on diamond
N78-29237
Theoretical analysis of solvent effects on polymer conformation
N78-29238
Grain boundary energetics in non-oxide ceramics
[AD-A054179] N78-29251

CATALYTICA ASSOCIATES, INC., PALO ALTO, CALIF.
Evaluation of sulfur-tolerant catalytic processes for producing peak-shaving alcohol fuels
[EPRI-AF-687] N78-29263
Assessment of fuel processing alternatives for fuel cell power generation
[EPRI-EM-570] N78-29596

CENTER FOR ENERGY POLICY, INC., BOSTON, MASS.
Solar energy applications centers: A strategy to facilitate the commercialization of solar energy in New England
[HCP/M4007-01] N78-29592

CENTRE DE RECHERCHES SCIENTIFIQUES ET TECHNIQUES DE L'INDUSTRIE DES FABRICATIONS METALLIQUES, BRUSSELS [BELGIUM].
Behaviour of pierced and cracked plates loaded beyond general yield
[CRIF-MT-119] N78-29519
External loadings on nozzles in cylindrical shells
[CRIF-MT-122] N78-29520

CENTRO DE INVESTIGACION CIENTIFICA Y DE EDUCACION SUPERIOR, DE ENSENADA, B.C. [MEXICO].
Coastal upwelling ecosystems analysis. Vertical sections of temperature, salinity and sigma-T. JOINT-II-R/V Thomas G. Thompson Cruise 108 Leg 1
[PB-279174/7] N78-29719

CER GEONUCLEAR CORP., LAS VEGAS, NEV.
Western gas sands project
[NVO/0655-100] N78-29597

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG [SWEDEN].
On a discrete Rodrigues' formula and a second class of orthogonal Hahn polynomials
[CTH-MATH-1977-12] N78-29864
Stability properties of a nonlinear differential system in applied mathematics
[CTH-MATH-1977-15] N78-29865

CHARLES RIVER ASSOCIATES, INC., CAMBRIDGE, MASS.
Inducing the development and adoption of socially efficient automotive technology
[PB-279454/3] N78-29465
Integrating policy analysis
[PB-279217/4] N78-29621

CINCINNATI UNIV., OHIO.
Analysis and numerical solution of three-dimensional viscous internal flow problems
[AD-A053692] N78-29413

CITY UNIV. OF NEW YORK.
Laser induced vibrational energy transfer and chemical reactions
N78-29431

CIVIL AEROMEDICAL INST., OKLAHOMA CITY, OKLA.
Comparative readability of enroute low altitude charts
[AD-A054796] N78-29078

CIVIL AND ENVIRONMENTAL ENGINEERING DEVELOPMENT OFFICE, TYNDALL AFB, FLA.
Proceedings of the Conference on Environmental Chemistry of Hydrazine Fuels
[AD-A054194] N78-29261

CLEMSON UNIV., S.C.
Analog and digital computer simulation of Coulomb friction
[PB-279465/9] N78-29467
Users' manual for Kalker's simplified nonlinear creep theory
[PB-279503/7] N78-29525

CNR, INC., NEEDHAM, MASS.
DEMOD/decoder integration
[AD-A053685] N78-29319

COLORADO STATE UNIV., FORT COLLINS.
Development of a subsurface hydrologic model and use for integrated management of surface and subsurface water resources
[PB-279629/0] N78-29554
Adaptive piecewise polynomial L1 approximation
[AD-A053651] N78-29822
System analysis of plasma centrifuges and sputtering
[NASA-CR-135079] N78-29916

COLUMBIA UNIV., NEW YORK.
Remote-oxidation of flexible hydrocarbon chains
N78-29148
Irreversible thermodynamic analysis of electrophoretic light scattering experiments
N78-29161
An assigned-slot listen-before-transmission protocol for a multiaccess data channel
N78-29296
Hydrodynamic theories of relaxation in liquids
N78-29393
Laser spectroscopy: Studies of the NO2 visible system
N78-29432
Joint observations of 4U1223-62 by the SAS-3 satellite and Columbia University proportional counter experiment on NASA rocket 26.054 UH
[NASA-CR-157356] N78-29539
Lifetimes of excited states of barium and lanthanum and the modification of the Hanle effect by strong optical pumping
N78-29884
Relaxation of third order elastic constants in crystals with point defects
N78-29943
Dynamics and stability of continuous crystallization systems: Evaporative crystallization of sucrose
N78-29947
Photohydrodynamic stability near the Eddington limit
N78-30014
The galactic distribution of carbon monoxide: An out-of-plane survey
N78-30021

COMPUTER SCIENCES CORP., FALLS CHURCH, VA.
Considerations for a small economical earth terminal
[AD-A053623] N78-29313

CONNECTICUT DEPT. OF TRANSPORTATION, WETHERSFIELD.
Development of a laboratory data system executive summary
[PB-279765/2] N78-29782
CONTROL DATA CORP., ARLINGTON, VA.
Interface milestone management [IM2] concept
[PB-279252/1] N78-29970
CORNELL UNIV., ITHACA, N. Y.
Morphology of vicinal surfaces of nickel and equilibrium segregation of carbon to Ni[111]
N78-29200
Theoretical and experimental studies of reactivity and bonding of transition-metal organometallic compounds
N78-29201
Direct observation of the point-defect structure of depleted-zones in ion-irradiated metals
N78-29213
Studies on clustered files
N78-29772
Succinctness of descriptions of context-free, regular and finite languages
N78-29788
Contributions to the theory of generalized block designs
N78-29854
High order contributions to the hyperfine structure in positronium and muonium
N78-29887
Monte Carlo simulation of the classical two-dimensional one component plasma
[NASA-CR-157467] N78-29911
Diffraction and high resolution electron microscopy studies of a linear defect in Zr-Nb b.c.c. solid solutions
N78-29955
Nonlinear order parameter fields. 1: Soliton dynamics. 2: Thermodynamics of a model impure system
N78-29963
Far-infrared photometry with an 0.4-meter liquid helium cooled balloon-borne telescope
N78-30012
A study of neutral hydrogen in early-type galaxies in the virgo cluster
N78-30020
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA [SOUTH AFRICA].
Space research in the Republic of South Africa: Report to COSPAR
N78-29125
The design of all-passes, low-passes and band-passes with a constant group delay approximated according to Chebishev
[CSIR-TRANS-1402] N78-29305
Recording of measuring data on a cassette tape recorder using commercial FM components
[CSIR-TRANS-1401] N78-29425
CULP/WESNER/CULP, EL DORADO HILLS, CALIF.
Operations manual: Sludge handling and conditioning
[PB-279449/3] N78-30002
Field manual for performance evaluation and troubleshooting at municipal wastewater treatment facilities
[PB-279448/5] N78-30003

D

DAYTON UNIV., OHIO.
A preliminary investigation of the interaction of M-50 steel with a perfluoalkylether fluid and a 1 percent additive-fluid formulation
[AD-A054044] N78-29253
An optimization study for generating surface-oriented coordinates for arbitrary bodies in high reflow
[AD-A054047] N78-29414
DECISIONS AND DESIGNS, INC., MCLEAN, VA.
The value of improved forecasts of climate for agricultural decision making
[PB-279452/7] N78-29713
DEFENCE RESEARCH ESTABLISHMENT VALCARTIER [QUEBEC].
TEA laser emission on the sequence bands of CO2
[AD-A054149] N78-29437
DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.
Direct access data migration system
[PB-280074/6] N78-29780
Disk inventory system
[PB-280068/8] N78-29781
DEPARTMENT OF ENERGY, WASHINGTON, D. C.
Satellite Power System [SPS] concept development and evaluation program plan, July 1977 - August 1980
[NASA-TM-79400] N78-29593
Proceedings of a conference on solar energy for heating greenhouses and greenhouse-residential combinations
[CONF-770367] N78-29610
DEPARTMENT OF THE ENVIRONMENT, OTTAWA [ONTARIO].
Retransmission of hydrometric data in Canada
[E78-10174] N78-29531
DESERT RESEARCH INST., RENO, NEV.
Modification of the continuous flow diffusion chamber for use in zero-gravity
[NASA-CR-150765] N78-29123
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BERLIN [WEST GERMANY].
The prediction of aerodynamic and wheel/rail noise generated by high-speed trains
[DLR-IB-257-77/14] N78-29877
On estimating the sound radiation of large radial ventilators from acoustic measurements at a model test stand
[DLR-IB-257-77/2] N78-29878
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BRUNSWICK [WEST GERMANY].
Calculation of pressure distribution, forces and moments for the fighter configuration IAe 60 by panel method
[DLR-IB-151-77/13] N78-29072
Calculation of the interference between civil-military transport aircraft engine and basis wing according to the vortex conductor procedure
[DLR-IB-151-77/19] N78-29075
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAFFENHOFEN [WEST GERMANY].
A seminumerical procedure for the calculation of geostationary orbit perturbations caused by the sun and the moon
[DLR-IB-552-77/23] N78-29130
The coverage behavior of ERDSAT for some selected regions of the world
[DLR-IB-552-78/1] N78-29548
The microprocessor INTEL 8080 A and its use as digital filter
[DLR-IB-552-77/22] N78-29779
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, STUTTGART [WEST GERMANY].
Measurement of small concentrations of pollutants in gases by an optical ac wavelength scanning method
[DLR-IB-453-78/1] N78-29196
DOUGLAS AIRCRAFT CO., INC., LONG BEACH, CALIF.
Winglet and long duct nacelle aerodynamic development for DC-10 derivatives
N78-29049
Advanced aerodynamics and active controls for a next generation transport
N78-29052
Precipitation static electricity and swept-stroke lightning effects on aircraft transparency coatings
[AD-A054225] N78-29372
DUKE UNIV., DURHAM, N. C.
Measurement techniques for the characterization in the frequency domain of regulated energy-storage DC-to-DC converters
[NASA-CR-157474] N78-29349
Heat transfer correlations for the nucleate, convective and dispersed regions of horizontal in-tube evaporation
N78-29965
DYNAMIC SCIENCE, PHOENIX, ARIZ.
Evaluation of rollover procedures: 45 Degree dolly rollovers
[PB-279392/5] N78-29468
DYNAMICS RESEARCH CORP., WILMINGTON, MASS.
Integration and application of human resource technologies in weapon system design
[AD-A053681] N78-29756
Integration and application of human resource technologies in weapon system design: Coordination of five human resource technologies
[AD-A053680] N78-29757
DYNATREND, INC., ARLINGTON, VA.
National Fuel Cell Seminar. Program and abstracts
[CONF-770664-ABSTS] N78-29614

E

E-SYSTEMS, INC., ST. PETERSBURG, FLA.
Digital communications/interoperability techniques
[AD-A053558] N78-29312
ECONERGY INC., LOS ANGELES, CALIF.
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-1] N78-29995
A study of characteristics of intercity transportation systems. Phase 1: Definition of transportation comparison methodology
[NASA-CR-152153-2] N78-29996
EG AND G WASHINGTON ANALYTICAL SERVICES CENTER, INC., ROCKVILLE, MD.
Comparative testing of Niskin and Vector averaging current meters
[AD-A054113] N78-29428
EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH [SWITZERLAND].
Geothermic model for the rise of deeper groundwater along faults in unconsolidated rocks
[NP-22877] N78-29601
EMPLOYMENT AND TRAINING ADMINISTRATION, WASHINGTON, D. C.
A review of energy models with particular reference to employment and manpower analysis
[PB-279447/7] N78-29989
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, MORGANTOWN, W. VA.
Test and evaluation of an aluminum oxide ball and seat in a ball valve
[MERC/RI-77/3] N78-29461
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D. C.
Methanation activity of Raney nickel catalysts: Effect of proportion of NiAAl3 and Ni2Al3 in precursor alloys
[PB-279656/3] N78-29198
ENGINEERING SCIENCES DATA UNIT, LONDON [ENGLAND].
Physical properties of design atmospheres
[ESDU-78008] N78-29660
ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D. C.
National water quality inventory 1976 report to Congress
[PB-279462/6] N78-29647
Laboratories needed to support long-term exploratory research in the US Environmental Protection Agency: A report to the President and the Congress, 31 March 1978
[PB-279607/6] N78-29971
EUROPEAN SPACE AGENCY, PARIS [FRANCE].
Nonlinear deformations and static buckling
[ESA-TT-478] N78-29524

F

FEDERAL COBOL COMPILER TESTING SERVICE, WASHINGTON, D. C.
Survey of conversion support software
[AD-A053741] N78-29798
FISH AND WILDLIFE SERVICE, FT. COLLINS, COLO.
Cooperative Instream Flow Service Group: The first year
[PB-279496/4] N78-29562
FLORENCE UNIV. [ITALY].
Synthesis of bandpass signals through the minimum number of samples
[R-5-77] N78-29330
A useful computer program for LC networks synthesis in time domain
[R-8-77] N78-29382
Large change sensitivity figure and new algorithm for its minimization
[R-9-77] N78-29856
FLORIDA UNIV., GAINESVILLE.
Pulsed laser-excited fluorescence
N78-29160
Oxygen and nitrogen diffusion in group V transition metals
N78-29205
Structural evolution and electrical conductivity of sintered uranium dioxide
N78-29206
Packing, sintering and blending of binary powder mixtures
N78-29207
Study of electronic properties in proton- and electron-irradiated GALAs and GAAs solar cell materials
[NASA-CR-157475] N78-29568
Concepts and techniques for evaluation of energy-related water problems
[PB-279608/4] N78-29619
Calculation of electron binding energies
N78-29882
Nuclear magnetism of solid helium-three
N78-29934
Nuclear resonance in dispersed systems
N78-29950
Energetics and systems modeling: A framework study for energy evaluation of alternative transportation modes
[AD-A053690] N78-29985
FLOW RESEARCH, INC., KENT, WASH.
Numerical solutions of the unsteady transonic small-disturbance equations
[AD-A054036] N78-29071
FOM-INSTITUUT VOOR PLASMAFYSICA, JUTPHAAS [NETHERLANDS].
Current-driven turbulence in plasmas
[REPT-77-106] N78-29929
FORD AEROSPACE AND COMMUNICATIONS CORP., PALO ALTO, CALIF.
Skynet SGEMP test program: The skynet satellite as test object
[AD-A054359] N78-29321

FUTURES GROUP, GASTONBURY, CONN.
Incorporating uncertainty in energy supply models
[EPRI-EA-703-VOL-2] N78-29602

G

GELLMAN RESEARCH ASSOCIATES, INC., JENKINTOWN, PA.
Technology transfer and other public policy implications of multi-national arrangements for the production of commercial airframes
[NASA-CR-159890] N78-29045
GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
Navigation planning--need for a new direction
[PB-278627/5] N78-29080
Municipal and industrial water conservation-the Federal government could do more
[PB-279487/3] N78-29556
Crop forecasting by satellite: Progress and problems
[PB-279437/8] N78-29561
Solar demonstrations on Federal residences: Better planning and management control needed
[PB-279485/7] N78-29624
Efforts by the Environmental Protection Agency to protect the public from environmental nonionizing radiation exposures
[PB-279483/2] N78-29746
Shifting the government's automatic data processing requirements to the private sector: Further study and better guidance needed
[PB-279482/4] N78-29783
Timeliness and completeness of FBI responses to requests under freedom of information and privacy acts have improved
[PB-279416/2] N78-29984
GENERAL ATOMIC CO., SAN DIEGO, CALIF.
Lower hybrid wave heating experiments at General Atomic
[GA-A-14810] N78-29920
Effect of lower hybrid waves on the evolution of the Doublet 2A plasma
[GA-A-14809] N78-29921
Coupling of lower hybrid waves in the doublet 2A high power RF heating experiments
[GA-A-14808] N78-29922
Limitations on lower hybrid heating of dense, hot plasmas
[GA-A-14783] N78-29923
GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.
Space shuttle orbiter reaction control system interactions with the vehicle flow field
[NASA-CR-151807] N78-29142
GENERAL ELECTRIC CO., CINCINNATI, OHIO.
Core compressor exit stage study. Volume 1: Blading design
[NASA-CR-135391] N78-29099
Long-term CF6 engine performance deterioration: Evaluation of engine S/N 451-380
[NASA-CR-159390] N78-29103
Design of impact-resistant boron/aluminum large fan blade
[NASA-CR-135417] N78-29104
GENERAL ELECTRIC CO., PHILADELPHIA, PA.
Electrophoretic separator for purifying biologicals, part 1
[NASA-CR-150768] N78-29183
Methods of fabricating ceramic materials
[AD-A054043] N78-29252
GENERAL ELECTRIC CO., SCHENECTADY, N. Y.
Time-domain two-dimensional computer simulation of three-terminal semiconductor devices
[AD-A054287] N78-29800
GENERAL ELECTRIC CO., WILMINGTON, MASS.
Solid Polymer Electrolyte [SPE] fuel cell technology program
[NASA-CR-151750] N78-29567
GEOLOGICAL SURVEY, RESTON, VA.
Ice on rivers and lakes: A bibliographic essay
[PB-279528/4] N78-29693
GEORGE WASHINGTON UNIV., WASHINGTON, D. C.
The frequency following response in humans
N78-29734
GEORGE WASHINGTON UNIV. MEDICAL CENTER, WASHINGTON, D.C.
Critical issues in scientific and technical communication: Perceptions of users, providers and policymakers
[PB-279382/6] N78-29982
GEORGIA INST. OF TECH., ATLANTA.
A stochastic model for fatigue and optimum design and maintenance methodologies
N78-29081
Noise suppression in jet inlets
[AD-A054173] N78-29107
Investigations into the determination of trace levels of iron, Part I: A field method for the determination of EDTA in natural water
N78-29159
New methods for improving sensitivity in trace analysis
N78-29164
The effects of microstructural features on the response of aluminum alloys to cyclic deformation
[AD-A053649] N78-29220
Hydrologic simulation in a semi-arid region
N78-29527
Wind energy statistics for large arrays of wind turbines, Great Lakes and Pacific Coast regions
[RLO/2439-77/2] N78-29590
Selected topics from the theory of electron-atom and atom-atom collisions
N78-29885
Heat transfer studies from single cylinder and tube bundle in fluidized bed
N78-29964
GESELLSCHAFT FUER VERGASUNG UND VERFLUESSIGUNG VON STEINKOHLE M.B.H., ESSEN [WEST GERMANY].
Study of capital requirements, cost estimates and economic analysis of a SRC-II [Solvent Refined Coal] plant under conditions related to the Federal Republic of Germany
[BMFT-FB-T-77-64] N78-29582
GREINER ENVIRONMENTAL SCIENCES, INC., BALTIMORE, MD.
Model environmental impact statement no. 1, Bicentennial International Airport, Northeast, America
[AD-A049171] N78-29628
Model environmental impact statement no. 2 for Freedom Airport, Southeast, America
[AD-A049300] N78-29629
GROSSMAN [R. E.] AND ASSOCIATES, CANOGA PARK, CALIF.
Representative industrial solar energy installation, Northridge Hospital, Northridge, California
[UCRL-13789] N78-29613
GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
Space station systems analysis study, program review
[NASA-CR-150764] N78-29116
Analysis of the optical memory and transducer requirements for the OMFIC system applied to guided projectiles
[AD-A054706] N78-29906

H

HAMILTON STANDARD, WINDSOR LOCKS, CONN.
Preliminary design of an accident Information Retrieval System [AIRS]
[HSER-7342] N78-29974
HARRIS CORP., MELBOURNE, FLA.
Intelligence security subsystem
[AD-A054508] N78-29776
HARRY DIAMOND LABS., ADELPHI, MD.
Solid-state ultrasonic catheter-tip flowmeter
[AD-A050963] N78-29740
HAWAII UNIV., HONOLULU.
Polarimetry of Be stars at 1.25 and 2.2 microns
N78-30013
HERCULES, INC., MAGNA, UTAH.
Coupling agents: HME resin system
[AD-A054394] N78-29153
HONEYWELL, INC., GOLDEN VALLEY, MINN.
Production Engineering Measure [PEM]: Manufacturing methods and technology for piezoelectric transformers
[AD-A054177] N78-29371
HORIZONS RESEARCH, INC., CLEVELAND, OHIO.
High resolution masks for ion milling pores through substrates of biological interest
[NASA-CR-135435] N78-29276
HOUSTON UNIV., TEX.
Ultrasonic simulation of MSBLS multipath fading for orbiter landing configuration
[NASA-CR-151752] N78-29302
Applications of hybrid and digital computation methods in aerospace-related sciences and engineering
[NASA-CR-157364] N78-29820
HUGHES AIRCRAFT CO., CULVER CITY, CALIF.
Advanced microwave radiometer antenna system study
[NASA-CR-156776] N78-29304
HUGHES AIRCRAFT CO., FULLERTON, CALIF.
Electronic equipment screening and debugging techniques
[AD-A053561] N78-29365
HUGHES AIRCRAFT CO., TORRANCE, CALIF.
Defense satellite communications system traveling Wave Tube Amplifier life test report. Volume 1: Twenty watt TWTA
[AD-A053739] N78-29360
HUGHES RESEARCH LABS., MALIBU, CALIF.
Engineering model 8-cm thruster subsystem
[NASA-CR-135406] N78-29147
Development of a multimode liquid-crystal light value
[AD-A054728] N78-29956

I

IBM WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, N.Y.
Selection rule effects in electronic excitations of chemisorbed molecules as studied by energy loss spectroscopy
[AD-A054105] N78-29894
IIT RESEARCH INST., CHICAGO, ILL.
Wisconsin test facility ground terminal corrosion study
[AD-A053715] N78-29363
Thermal model of laser-induced skin damage: Computer program operator's manual
[AD-A053416] N78-29738
ILLINOIS INST. OF TECH., CHICAGO.
Some investigations relating to the elastostatics of a tapered tube
[AD-A054330] N78-29508
ILLINOIS UNIV. AT CHICAGO CIRCLE, CHICAGO.
Optimization techniques in designing relational database systems
N78-29770
Densities of states and spectral weight functions for disordered systems
N78-29939
The valence-core exchange model
N78-29945
ILLINOIS UNIV. AT URBANA-CHAMPAIGN, URBANA.
The high pressure kinetics of a halide exchange reaction
N78-29163
Critical evaluation of some atom reservoirs for atomic fluorescence spectroscopy
N78-29165
Thermodynamics of oxygen in solid solution in vanadium and niobium-vanadium alloys
N78-29174
Liquid metals as process solvents: Design techniques for magnesium oxide reduction
N78-29199
Detailed application of a technology for the formulation and expression of standards applicable to the American National Standard Building Code requirements for minimum design loads in buildings and other structures [ANSI A58.1-1972]
[PB-279091/3] N78-29289
An energy method for analyzing wave propagation in viscous flow in an elastic tube surrounded by an elastic medium
N78-29399
Interpretation of the turbulent flow in the viscous wall region as a driven flow
[AD-A053404] N78-29411
Discrete structural optimization
N78-29490
Predicted effects of residual stresses on butt weld fatigue life
N78-29494
Activated carbon adsorption of trace organic compounds
[PB-279253/9] N78-29654
WALSHSTORE: The application of burst processing to fail-soft storage systems using Walsh transforms
N78-29766
Further results regarding multiprocessor systems
N78-29769
Analyzing the learning of computer programming concepts through the teaching of PAL
N78-29787
Singular perturbation of nonlinear regulators and systems with oscillatory modes
N78-29807
Backward resonance production in pi minus plus proton goes to neutron pi plus pi minus 8 GeVc
N78-29889
Annealing studies of beryllium in gallium arsenide and gallium arsenide phosphide
N78-29940
The thermal boundary conductance between a thin He-4 film and its substrate
N78-29946
The effects of melt-crystal interface temperature rise on the analysis of crystal growth in binary borate glass melts
N78-29948
ILLINOIS UNIV., URBANA.
ERDA net energy analysis program
[COO-2865-11] N78-29598
Energetic particles and ionization in the nighttime middle and low latitude ionosphere
[NASA-CR-156943] N78-29665
INCO, INC., MCLEAN, VA.
Transparent integrated intelligence network: Response normalization
[AD-A054308] N78-29773

INDIAN SPACE RESEARCH ORGANIZATION, AHMEDABAD.
Indian National Committee for Space Research [INCOSPAR]
[REPT-16] N78-29124
INFORMATICS, INC., ROCKVILLE, MD.
Foreign noise research in noise effects. A survey of foreign noise effects research
[PB-279383/4] N78-29650
INSTITUTE OF INDUSTRY OF CEMENT BUILDING MATERIALS, OPOLE [POLAND].
Tests of fabric filtration materials
[PB-279637/3] N78-29648
INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS [BRAZIL].
Tracking station for meteorological satellites with a high resolution radiometer
[INPE-1040-RAE/027] N78-29135
Evaluation of wavelength groups for discrimination of agricultural cover types
[NASA-CR-157393] N78-29536
Effects of systemic and non-systemic stresses on the thermal characteristics of corn
[NASA-CR-157391] N78-29537
Project geological map to the millionth scale
[INPE-1074-NTE/100] N78-29540
Introduction to a multispectral data analysis system
[INPE-1227-NTE/115] N78-29541
Solar radiation and its agricultural utilization on the hillsides of northeast Brazil
[INPE-1005-TPT/049] N78-29542
Determination of various topographies using photographic texture analysis of LANDSAT images
[INPE-1077-NTE/103] N78-29543
On the maintenance of Walker circulation
[INPE-1260-PE/136] N78-29666
Simultaneous observations of the Na 5893A
[INPE-1081-PE/067] N78-29667
Dynamics of stratospheric winds in the Southern Hemisphere
[INPE-1065-PE/064] N78-29670
Diagnostic model of extratropical perturbation studies
[INPE-1108-PE/082] N78-29671
Ionospheric electrical fields
[INPE-1144-PE/098] N78-29676
Nightglow mediums [5893A] and their correlation with atmospheric sodium concentration
[INPE-1032-PE/057] N78-29677
Procedures to accomplish quality control of meteorological altitude data
[INPE-1037-NTE/089] N78-29700
Updating the input-output matrix using mathematical methods
[INPE-1055-PE/062] N78-29792
An XPL/ALGOL translator
[INPE-1304-TPT/096] N78-29793
Introduction to the kinetic theory of plasma turbulence
[INPE-1196-PE/112] N78-29917
A methodology to regional planning
[INPE-1263-TPT/087] N78-29967
INSTITUTO GEOGRAFICO Y CATASTRAL, MADRID [SPAIN].
Geomagnetic map of Spain for 1975
N78-29689
INTERNATIONAL BUSINESS MACHINES CORP., HOPEWELL JUNCTION, N. Y.
Damage profiles in silicon and their impact on device reliability
[AD-A053622] N78-29364
INTERNATIONAL BUSINESS MACHINES CORP., SAN JOSE, CALIF.
The synthesis of substituted nickel dithiene complexes with intense electronic transitions in the infrared region
[AD-A054675] N78-29439
IONICS, INC., WATERTOWN, MASS.
Anion permselective membrane
[NASA-CR-135316] N78-29574
IOWA UNIV., IOWA CITY.
Thermal regimes of the Mississippi and Missouri Rivers downstream from the southern Iowa border
[PB-279470/9] N78-29563
Function schemata
N78-29785
A molecular dynamics study of a system of hard spherocylinders
N78-29890
Observations pertaining to the dynamics of the plasma sheet
N78-29908
IRT CORP., SAN DIEGO, CALIF.
Measurements of selected charge transfer processes at low energies
[AD-A054360] N78-29683
ITT AEROSPACE/OPTICAL DIV., FORT WAYNE, IND.
Vehicular intercommunications system
[AD-A054021] N78-29327

J

JAPAN BROADCASTING CORP., TOKYO.
Ghost analyzer for measuring TV ghost waves
[NHK-LABS-NOTE-223] N78-29300
Evaluation of the cumulative failure rate of a system: The optimal interval for preventive replacement of traveling wave tubes
[NHK-LABS-NOTE-222] N78-29342
PCM video recording using a rotating magnetic sheet
[NHK-LABS-NOTE-221] N78-29423
The apparent rate of flicker
[NHK-LABS-NOTE-219] N78-29748
Defect-free epitaxial layers for Si-vidicon targets
[NHK-LABS-NOTE-220] N78-29954
JET PROPULSION LAB., CALIF. INST. OF TECH., PASADENA.
Magneto-optic detection system with noise cancellation
[NASA-CASE-NPO-11954-1] N78-29421
JOHNS-MANVILLE RESEARCH AND DEVELOPMENT CENTER, DENVER, COLO.
Effectiveness of building insulation applications
[AD-A053452] N78-29277

K

KANSAS STATE UNIV., MANHATTAN.
Application of negative chemical ionization mass spectrometry to the analysis of bovine tissue for chlorodibenzo-p-dioxins and related compounds
N78-29171
The threshold point model
N78-29855
Numerical simulation and optimization of chemical processes-application to solid waste gasification
N78-29990
KANSAS UNIV. CENTER FOR RESEARCH, INC., LAWRENCE.
A theoretical investigation of ground effects on USB configurations
[NASA-CR-157355] N78-29086
KENTUCKY UNIV., LEXINGTON.
Synthetic oil from coal: The economic impact of five alternatives for making hydrogen from coal
[PB-279322/2] N78-29273
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 4: Prediction of crosstalk in ribbon cables
[AD-A053548] N78-29355
Applications of multiconductor transmission line theory to the prediction of cable coupling. Volume 5: Prediction of crosstalk involving twisted wire pairs
[AD-A053559] N78-29356
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[AD-A053560] N78-29357
Estimating environmental damages from surface mining of coal in Appalachia: A case study
[PB-279150/7] N78-29553
Proceedings: 3rd Kentucky Coal Refuse Disposal and Utilization Seminar
[PB-279321/4] N78-29559
KRALL MANAGEMENT, INC., RADNOR, PA.
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[PB-278072/4] N78-29976
KTECH CORP., ALBUQUERQUE, N. MEX.
Measurement of isochoric pressure-energy for porous materials, part 1. Stress-matching technique and reference material results
[AD-A054329] N78-29223

L

LABORATORIUM FUER BETRIEBSFESTIGKEIT, DARMSTADT [WEST GERMANY].
Fatigue tests on I-beams of steel St 52-3
[FB-91] N78-29497
Handling of fatigue data in computer analysis
N78-29498
Low cycle-fatigue and fracture behaviour as parameters for the dimensioning of high pressure vessels
[ICAF-1012] N78-29499
Fatigue strength of a fibre-reinforced material
N78-29500
Computation of the irregularity-factor N sub o/N sub I of a stationary Gaussian process with dual peak power spectral density
[TB-137] N78-29501
The method of maximum likelihood applied to the statistical analysis of fatigue data including run-outs
[ICAF-1036] N78-29504
LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, N. Y.
Lunar breccias, petrology, and earth planetary structure
[NASA-CR-157361] N78-30028
LASER DIODE LABS., INC., METUCHEN, N. J.
Light emitting diodes for fiber optic communications
[AD-A053657] N78-29903
LEHIGH UNIV., BETHLEHEM, PA.
Finite elements for the elastic analysis of composite beams and bridges
N78-29496
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Bandwidth limitations on achievable cancellation for adaptive nulling systems
[AD-A054160] N78-29326
Some results on phase-coded waveforms with application to reduction of interference between radars
[AD-A054033] N78-29328
Advanced electronic technology
[AD-A054478] N78-29374
Electrooptical devices
[AD-A054477] N78-29907
LIQUID METAL ENGINEERING CENTER, CANOGA PARK, CALIF.
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[SAN/0700-1] N78-29460
LITTLE [ARTHUR D.], INC., CAMBRIDGE, MASS.
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[PB-279196/0] N78-29272
LITTON SYSTEMS, INC., MORRIS PLAINS, N. J.
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[AD-A054224] N78-29441
LOCKHEED-CALIFORNIA CO., BURBANK.
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[AD-A054317] N78-29084
General aviation airplane structural crashworthiness user's manual. Volume 3: Related design information
[AD-A054266] N78-29085
Fracture mechanics for structural adhesive bonds
[AD-A054023] N78-29509
LOCKHEED-CALIFORNIA CO., SAN DIEGO.
Development and flight evaluation of active controls in the L-1011
N78-29051
LOCKHEED ELECTRONICS CO., HOUSTON, TEX.
Modifications to the accuracy assessment analysis routine SPATL to produce an output file
[NASA-CR-151810] N78-29791
Modifications to the accuracy assessment analysis routine MLTCRP to produce an output file
[NASA-CR-151811] N78-29794
LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF.
Laser fusion power balance measurements [particle transmission diagnostics]
[EPRI-ER-591] N78-29444
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Anion exchange of 58 elements in hydrobromic acid and in hydriodic acid
[LA-7084] N78-29191
Processes of plastic deformation, their conditions and effect on the properties of the final product
[LA-TR-77-68] N78-29279
Modern ultrafast streak camera development and application review
[LA-UR-77-2474] N78-29429
Laser-fusion program at Los Alamos
[LA-UR-77-174] N78-29443
Structural design for a 10-GWh SMES vacuum vessel
[LA-7110-MS] N78-29514
Technique for dynamic range reduction for LANDSAT ratio images
[LA-UR-78-347] N78-29546
Geothermal reservoir categorization and stimulation study
[LA-6889-MS] N78-29547
Respirator studies for the Nuclear Regulatory Commission. Protection Factors for supplied-air respirators
[LA-7098-PR] N78-29760
Fiber optics and microprocessors: A control-system solution for the laser-fusion environment
[LA-UR-78-329] N78-29777
Computer assisted cost estimating at Los Alamos Scientific Laboratory
[LA-UR-77-2070] N78-29778
Recent development in the Sesame equation-of-state library
[LA-7130] N78-29804
GAC-ANL TNS scoping studies. Volume 11: TNS doublet Tokamak ohmic-heating power supply study
[GA-A-14614-VOL-11] N78-29919
Second Topical Conference on High-Temperature Plasma Diagnostics
[LA-7160C] N78-29927

Microwave absorption studies near the plasma frequency
[LA-UR-78-51] N78-29928
LOUGHBOROUGH UNIV. OF TECHNOLOGY [ENGLAND].
Methanol as a possible fuel for automotive use
[TT-7708] N78-29259
An investigation of rotor noise generation by aerodynamic disturbance
[NASA-CR-157571] N78-29870
LOUISIANA DEPT. OF TRANSPORTATION AND DEVELOPMENT, BATON ROUGE.
Skid resistance study
[PB-279588/8] N78-29464
LOUISVILLE UNIV. FOUNDATION, INC., KY.
Support of ASTP/KOSMOS fundulus embryo development experiment
[NASA-CR-151816] N78-29724
LUNAR AND PLANETARY INST., HOUSTON, TEX.
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[NASA-CR-157468] N78-29663

M

MAGCAP ENGINEERING, CANTON, MASS.
Design of space-type electronic power transformers
[NASA-CR-134992] N78-29353
MAINE DEPT. OF TRANSPORTATION, AUGUSTA.
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[PB-279224/0] N78-29293
MANCA [VARLERIE M.], LOS ALAMOS, N. MEX.
Processes of plastic deformation, their conditions and effect on the properties of the final product
[LA-TR-77-68] N78-29279
MARQUETTE UNIV., MILWAUKEE, WIS.
Finite element analysis of rotor-bearing systems with matrix reduction
N78-29492
MARTIN MARIETTA AEROSPACE, DENVER, COLO.
Experimental investigation of contamination prevention techniques to cryogenic surfaces on board orbiting spacecraft
[NASA-CR-152171] N78-29146
MARTIN MARIETTA CORP., DENVER, COLO.
Preliminary study of the reliability of imaging charge coupled devices
[NASA-CR-150761] N78-29352
MARYLAND UNIV., BALTIMORE.
Estimation and detection of Lie groups
[AD-A053633] N78-29821
MARYLAND UNIV., COLLEGE PARK.
Electronic structure of equiatomic alloys of aluminum with iron, cobalt and nickel
N78-29212
A comparison of the axiomatic and functional models of structured programming
[AD-A053629] N78-29795
Calculation of the laser induced Stark shifts in diatomic molecules
[AD-A053637] N78-29892
Organic molecules in the atmosphere of Jupiter
[NASA-CR-156793] N78-30026
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
A study of the lift-to-drag ratio capability of caret wing waveriders
[AD-A053691] N78-29069
Corrosion fatigue of high strength aircraft structural materials - crystallographic dependence of fracture path in Al-Zn-Mg [7075] alloys
[AD-A053743] N78-29221
The use of redundant packets in slotted-Aloha-type radcom-access systems
[AD-A053737] N78-29318
The computation of immediate texture discrimination
[AD-A053804] N78-29810
High energy electron radiation of waste-water liquid residuals
[PB-279489/9] N78-30001
MASSACHUSETTS UNIV., AMHERST.
Studies of solid-catalyzed systems subject to catalyst deactivation and diffusional limitations
N78-29176
A spectroscopic investigation of the hydrogennitric oxide flame
N78-29178
Linear polybenzyl derivatives
N78-29239
High-pressure X-ray diffraction study of linear polyethylene
N78-29240
Prototype maser amplifiers for three milimeter wavelength
N78-29434
The Bohl transformation and oscillation of linear differential systems
N78-29817
Light scattering from Saturn's rings calculated by a Markov chain formalism
N78-30024
MATERIAL SYSTEMS CORP., ESCONDIDO, CALIF.
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[PB-279440/2] N78-29286
MAYA DEVELOPMENT CORP., SAN DIEGO, CALIF.
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[NASA-CR-156948] N78-29674
MCDONNELL AIRCRAFT CO., ST. LOUIS, MO.
Summary of landing gear initial flaws
[AD-A054048] N78-29095
MCELROY [RALPH] CO., AUSTIN, TEX.
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[UCRL-TRANS-11326] N78-29227
Measurement at cooling tower plumes. Part 1: Mathematical simulation and importance of measurements
[ANL-TRANS-1115-PT-1] N78-29632
Measurements at cooling tower plumes. Part 3: Three-dimensional measurements at cooling tower plumes
[ANL-TRANS-1117-PT-3] N78-29633
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[AD-A054533] N78-29108
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[NASA-CR-135402] N78-29449
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[MBL-1977-5] N78-29743
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MICHIGAN STATE UNIV., EAST LANSING.
Computer assisted characterization of a filament electrothermal atomizer
N78-29168
Basic and practical investigations of automated stopped-flow mixing systems
N78-29172
Raman scattering from two-phonon excitations and from electronic nitrogen impurity levels in cubic silicon carbide
N78-29938
A study of the vibrational spectra of the partially-deuterated polycrystalline ethylenes
N78-29951
MICHIGAN UNIV., ANN ARBOR.
Nonlinear analysis of plasma instability excited by the auroral electrojet
[AD-A053647] N78-29678
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[NASA-CR-157359] N78-30022
MICROECONOMIC ASSOCIATES, BERKELEY, CALIF.
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[EPRI-EA-586] N78-29599
MIDWEST RESEARCH INST., KANSAS CITY, MO.
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[PB-279828/8] N78-29655
MINNESOTA UNIV., MINNEAPOLIS.
Studies in the synthesis of control structures for chemical processes
N78-29162
Electron microscopy of crystalline and amorphous electrodeposited thin Ni-P films
N78-29208
Fluid motion between two cylinders rotating at different speeds
N78-29394
Dynamics of high-speed linkages with elastic members
N78-29448
Aerodynamic particle size measurement by laser-Doppler velocimetry
N78-29627
Linear equivalences in hereditary control systems
N78-29808
Fourier-Wiener transforms of functionals of one and several Wiener variables
N78-29816
Collisional stabilization of chemically activated molecules
N78-29891
An experimental study of the chemical composition of the heavy cosmic ray nuclei
N78-30034
MISSION RESEARCH CORP., SANTA BARBARA, CALIF.
Propagation of microwave satellite communication signals through striated media
[AD-A054677] N78-29324
MISSOURI UNIV., COLUMBIA.
Shock tube studies of formaldehyde pyrolysis
[AD-A053695] N78-29185
Decision rules and decision tree approach in pattern recognition theory
N78-29809
MISSOURI UNIV., ROLLA.
Inelastic bending of beams under time-varying moments: A state variable approach
[COO-2733-15] N78-29511
MONOSOLAR, INC., SANTA MONICA, CALIF.
Improved semiconductors for photovoltaic solar cells
[DSE/2457-4] N78-29595
Improved semiconductors for photovoltaic solar cells
[DSE/2457-5] N78-29759

N

NAGOYA UNIV. [JAPAN].
A heating mechanism of ions due to large amplitude coherant ion acoustic wave
[IPPJ-333] N78-29912
Anomalous ion loss by low frequency instabilities
[IPPJ-334] N78-29913
High-pressure equilibria of a small-aspect-ratio tokamak
[IPPJ-335] N78-29914
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[PB-279539/1] N78-29623
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[PB-279534/2] N78-29640
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[PB-279536/7] N78-29641
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[PB-279370/1] N78-29653
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[PB-279464/2] N78-29659
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N78-29054
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[NASA-NEWS-RELEASE-78-129] N78-29115
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The NASTRAN user's manual: Level 16.0 supplement
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[NASA-TM-78489] N78-29044
A method for the analysis of the benefits and costs for aeronautical research and technology
N78-29060
Short-haul CTOL aircraft research
N78-29061
Wind tunnel investigation of computationally optimized variable camber wing configurations
[NASA-TM-78479] N78-29067

Closed-form equations for the lift, drag, and pitching-moment coefficients of airfoil sections in subsonic flow
[NASA-TM-78492] N78-29068
On the possibility of negative activation energies in bimolecular reactions
[NASA-TM-78509] N78-29149
System optimization of gasdynamic lasers, computer program user's manual
[NASA-TM-73193] N78-29436
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[NASA-TM-78501] N78-29451

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Nonlinear Landau damping in the ionosphere
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[NASA-CASE-GSC-12348-1] N78-29902
Long-term studies with the Ariel-5 asm. 1: Her X-1, Vela X-1 and Cen X-3
[NASA-TM-79605] N78-30018
Interplanetary magnetic holes: Theory
[NASA-TM-79599] N78-30023
A new inversion method for remote sounding of planetary atmospheres
[NASA-TM-79604] N78-30027
Energy spectrum of medium energy gamma-rays from the galactic center region
[NASA-TM-78331] N78-30035
Fabrication of light guides for astrophysics experiments
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The annihilation of galactic positrons
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N78-29047
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N78-29048
Wake vortex technology
N78-29055
Summary of NASA landing-gear research
N78-29056
Noise prediction technology for CTOL aircraft
N78-29057
Flight experiments to improve terminal area operations
N78-29058
Estimating airline operating costs
N78-29059
Progress in supersonic cruise aircraft technology
N78-29062
Progress on coal-derived fuels for aviation systems
N78-29063
Studies of advanced transport aircraft
N78-29064
Microstrip back-fire antenna
[NASA-CASE-LAR-12172-1] N78-29310
Laser Doppler velocity simulator
[NASA-CASE-LAR-12176-1] N78-29435
A phase insensitive ultrasonic transducer
[NASA-CASE-LAR-12304-1] N78-29871

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[NASA-TM-73507-VOL-1] N78-29100
Adhesion of a bimetallic interface
[NASA-TM-78890] N78-29214
Rub tolerance evaluation of two sintered NiCrAl gas path seal materials
[NASA-TM-78967] N78-29215
Reactions of yttria-stabilized zirconia with oxides and sulfates of various elements
[NASA-TM-78942] N78-29216
Pressureless sintered beta prime-Si3N4 solid solution: Fabrication, microstructure, and strength
[NASA-TM-78950] N78-29245
Substitution of ceramics for high temperature alloys
[NASA-TM-78931] N78-29246
Liquid propellant reorientation in a low-gravity environment
[NASA-TM-78969] N78-29407
Performance and stability analysis of a photovoltaic power system
[NASA-TM-78880] N78-29566
Large wind turbine generators
[NASA-TM-73767] N78-29575
Thermal energy storage for industrial waste heat recovery
[NASA-TM-78953] N78-29576
Storage systems for solar thermal power
[NASA-TM-78952] N78-29577
Utilization of solar energy in developing countries: Identifying some potential markets
[NASA-TM-78964] N78-29578
The 200-kilowatt wind turbine project
[NASA-TM-79757] N78-29583
A stirling engine computer model for performance calculations
[NASA-TM-78884] N78-29994

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[NASA-TM-78179] N78-29572
Development, testing, and certification of life sciences engineering solar collector
[NASA-TM-78182] N78-29573
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[NASA-CP-2056] N78-29669
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[NLR-MP-77025-U] N78-29073
Investigations of the transonic flow around oscillating airfoils
[NLR-TR-77090-U] N78-29074
Assessment of service load experience using AIDS-recorded data
[NLR-MP-77011-U] N78-29096
IRAS on-board software
[NLR-MP-77037-U] N78-29138
Computer aided EMC analysis - a review of available tools
[NLR-TR-77070-U] N78-29331
Theory and design of conventional heat pipes for space applications
[NLR-TR-77001-U] N78-29420
Repair machining and inspection of cracked components
[NLR-MP-77018-U] N78-29483
Microscopic study of stress corrosion crack growth in an AlZnMg alloy
[NLR-MP-77004-U] N78-29518
Pilot workload analysis based upon in-flight physiological measurements and task analysis methods
[NLR-MP-76001-U] N78-29762
Human control and monitoring-models and experiments
[NLR-MP-76015-U] N78-29763
Reduction and smoothing of multivariate time series with curve fitting methods
[NLR-MP-77014-U] N78-29853

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Automatic path delay corrections to GOES [Geostationary Operational Environmental Satellites] satellite time broadcasts
[PB-279335/4] N78-29334
Transients in resistively loaded antennas and their comparison with conical antennas and TEM horns
[PB-279640/7] N78-29335
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[PB-279684/5] N78-29866

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[PB-279336/2] N78-29488
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[NPL-CHEM-79] N78-29193
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A method for the estimation of the critical temperatures of alkanols
[NPL-CHEM-81] N78-29195
A temperature controlled water bath for viscosity measurement
[NPL-MOM-24] N78-29281
Determination of temperature and differential scattering cross-sections from rotational Raman scattering of laser radiation at 488.0 nm
[NPL-QU-43] N78-29447
The deformation of steel bars in a four-point bending machine, measured by holographic interferometry
[NPL-MOM-27] N78-29517
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[NPL-NAC-87] N78-29839

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[PB-279458/4] N78-29972

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[NTIS/PS-78/0445/3] N78-29616
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[NTIS/PS-78/0502/1] N78-29617
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[NTIS/PS-78/0503/9] N78-29618
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[NTIS/PS-78/0508/8] N78-29978
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[PB-280943/2] N78-29711
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[PB-210710/5] N78-29560
NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
Powered inertia reel retraction during ejection
[AD-A054157] N78-29077
NAVAL AIR ENGINEERING CENTER, LAKEHURST, N.J.
Technical data requirements for shipboard and shorebased vertical/short takeoff and landing V/STOL aircraft
[AD-A054102] N78-29093
Development of corrosion resistant fastening systems for aircraft carrier steam catapults
[AD-A053656] N78-29112
NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
Nansen-Drift Station Project: Remote sea-ice runway construction
[AD-A054720] N78-29113
Effectiveness of over-rust primer for Naval shore facilities
[AD-A053557] N78-29247
Power system simulator
[AD-A054476] N78-29375
Analysis of Chamberlin flat plate solar collector using National Bureau of Standards test criteria
[AD-A054215] N78-29588
NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Shock induced structural response
[AD-A053877] N78-29507
Tropical wave dynamics
[AD-A054302] N78-29706
NAVAL RESEARCH LAB., WASHINGTON, D. C.
High performance composites and adhesives for V/STOL aircraft
[AD-A054637] N78-29154
The 1977 NRL air quality data
[AD-A054634] N78-29631
An experiment in database access control
[AD-A054189] N78-29775
Hydrophone preamplifier optimization: Prediction of hydrophone self-noise by a noise model
[AD-A053449] N78-29874
A low-frequency limitation of FACT
[AD-A054371] N78-29875
A new collective particle accelerator
[AD-A053759] N78-29893
Possible new irdome materials for transmission to 4.5 - 5 micrometers
[AD-A053732] N78-29905
A general two-dimensional tokamak model
[AD-A054413] N78-29918
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.
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[AD-A053643] N78-29726
NAVAL SURFACE WEAPONS CENTER, WHITE OAK, MD.
Thin film corrosion of anodized high-strength aluminum alloys
[AD-A054424] N78-29224
Electrical properties of Pb0.8Sn0.2Te spitaxial films
[AD-A053456] N78-29361
Lithium-boron alloy anodes for molten salt batteries, I
[AD-A053621] N78-29587
An inverse regression method for determining an ensemble of state error vectors from a covariance matrix
[AD-A054214] N78-29845
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[AD-A053422] N78-29727
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N78-29662
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N78-29166
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N78-29297
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[AD-A054349] N78-29070
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[PB-279391/7] N78-29526
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N78-29167
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N78-29169
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N78-29767
Toward a theory of probabilistic automata with environments
[AD-A053986] N78-29811
Calculations of atomic inner-shell vacancy yields and their dependence on collision parameters
N78-29886
Nuclear spin-lattice relaxation in small metallic particles
N78-29937
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Weldbraze airframe components
[AD-A054042] N78-29457
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[PB-279693/6] N78-29980
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[PB-279584/7] N78-29747

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[ORNL-TM-5934] N78-29742
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[ORNL-TR-4528] N78-29924
Ripple bundle divertor for Tokamaks
[ORNL-TM-6220] N78-29926
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[ORNL-TM-5989] N78-29962
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[NASA-CR-156795] N78-29134
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[NASA-CR-156785] N78-29307
Radam phenomena of tracked vehicles
[AD-A053634] N78-29315
Gain degradation and amplitude scintillation due to tropospheric turbulence
[NASA-CR-156796] N78-29668
Providing computer-based information services to an academic community
[PB-278330/6] N78-29975
OKLAHOMA STATE UNIV., STILLWATER.
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N78-29065
Estimation of the performance of shell and tube heat exchanger systems when uncertainties exist
N78-29396
A study of correlation among error terms of a repeated measures design
N78-29815
Energy transfer and dissipation processes in doped crystals
N78-29941
OREGON GRADUATE CENTER, BEAVERTON.
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N78-29625
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[PB-279605/0] N78-29645
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N78-29857
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[NASA-CR-150766] N78-29182
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P

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[AD-A053618] N78-29366
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[AD-A053684] N78-29799
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
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[AD-A053745] N78-29222
Polymeric replamineform biomaterials and a new membrane structure
N78-29241
General multi-configuration Hartree-Fock program: MCHF77
[COO-4264-1] N78-29805
PITTSBURGH UNIV., PA.
Active sites of dealuminated hydrogen mordenite
N78-29179
Dynamic strain aging behavior and its impact on tensile and creep deformation of Ti-5Al-2.5Sn
N78-29202
Analysis of fluid dynamics during rapid depressurization of systems containing high enthalpy water
N78-29397
Heat transfer during transition from film to nucleate boiling of water in force convection upward flow
N78-29398
Stress analysis of a viscoelastic material in the calendering process
N78-29493
PRATT AND WHITNEY AIRCRAFT GROUP, EAST HARTFORD, CONN.
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[NASA-CR-135407] N78-29105
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 1
[NASA-CR-135189-VOL-1] N78-29867
Flight effects on the aerodynamic and acoustic characteristics of inverted profile coannular nozzles, volume 2
[NASA-CR-135189-VOL-2] N78-29868
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[NASA-CR-135189-VOL-3] N78-29869
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N78-29346
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N78-29404
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[AD-A053417] N78-29088
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[AD-A053635] N78-29184
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[AD-A053695] N78-29185
The anomalous voltage response of the P[+]N[-]N[+] device and its effects on second breakdown
[AD-A053539] N78-29359
The effects of substrate composition on thick film circuit reliability
[AD-A054316] N78-29958

Q

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[AD-A054676] N78-29758

R

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[PB-279641/5] N78-29275
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[AD-A053412] N78-29477
Storage reliability of missile materiel program, relay analysis
[AD-A053413] N78-29478
Storage reliability of missile materiel program, monolithic bipolar SSI/MSI digital and linear integrated circuit analysis
[AD-A053415] N78-29479
Storage reliability of missile materiel program, switch analysis
[AD-A053414] N78-29480
Storage reliability of missile materiel program, missile systems battery analysis
[AD-A053410] N78-29481
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[AD-A054562] N78-29377
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Evaluation of the propulsion control system of a planetary rover and design of a mast for an elevation scanning laser/multi-detector system
[NASA-CR-157465] N78-29131
Elevation scanning laser/multi-sensor hazard detection system controller and mirror/mast speed control components
[NASA-CR-157466] N78-29132
Electrical properties and structure of BaO-B2O3-SiO2 glass containing titanium ions
N78-29204
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[FOA-B-20009-D4[F3]] N78-29228
Penetration of solvents in plastic material
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[FOA-C-20213-D3] N78-29264
Determination of RDX in UC-36
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[FOA-C-20221-E4] N78-29383
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[FOA-C-20184-D4] N78-29418
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Metabolism of 181W-labeled sodium tungstate in goats
[FOA-C-40070-A3] N78-29732
Comparison between flight test data and data from a theoretical model for the discovery of a ground target from the air
[FOA-C-56010-H9/H6] N78-29751
Medical evaluation of 2-pressure suit used in explosive decompressions up to 20.000 m altitude
[FOA-A-59002-H3] N78-29761
Efficient matrix transposition with limited high speed storage
[FOA-B-30021-E1] N78-29790
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[FOA-C-20187-E4] N78-29813
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ROCKWELL INTERNATIONAL CORP., DOWNEY, CALIF.
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 1: Representative payload definition
[NASA-CR-145348-VOL-1] N78-29119
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 2: Ground Processing requirements
[NASA-CR-145348-VOL-2] N78-29120
Spacelab Level 4 programmatic Implementation Assessment Study. Volume 3: Optimization and programmatics
[NASA-CR-145348-VOL-3] N78-29121
Spacelab Level 4 Programmatic Implementation Assessment Study. Volume 4: Executive summary
[NASA-CR-145348-VOL-4] N78-29122
Quick look test report: MPT static firing no. 2 test MPT-S2
[NASA-CR-151814] N78-29141
Integrated guidance, navigation and control verification plan primary flight system
[NASA-CR-151815] N78-29144
ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.
High temperature mechanical properties of polyphase ceramics based on silicon nitride
[AD-A054342] N78-29248
ROHR INDUSTRIES, INC., CHULA VISTA, CALIF.
Preliminary power train design for a state-of-the-art electric vehicle
[NASA-CR-135340] N78-29584
ROSENBAUM [BERNARD B.], ARLINGTON, VA.
Closed cycle Brayton turbomachinery research
[AD-A053024] N78-29586
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH [ENGLAND].
Examination of the mechanical properties of products of titanium alloys obtained by an original hot-working technique
[RAE-LIB-TRANS-1969] N78-29218
The RIAR system, a new telecommunication system. High-altitude, artificially-ionised regions. Possible extension to VHF, UHF and SHF telecommunication
[RAE-LIB-TRANS-1968] N78-29311
Measurement of the coupling impedance and cross-talk between coaxial conductors
[RAE-LIB-TRANS-1961] N78-29354
Determination of bending stresses in a spur gear tooth
[RAE-LIB-TRANS-1923] N78-29452
ROYAL INST. OF TECH., STOCKHOLM [SWEDEN].
Review of magnetospheric boundary layer phenomena and relations to current theories
[TRITA-EPP-77-25] N78-29691
ROYAL NETHERLANDS METEOROLOGICAL INST., DE BILT.
The accuracy of aspiration thermometers
[KNMI-WR-78-1] N78-29430
RUHRCHEMIE A.G., OBERHAUSEN [WEST GERMANY].
Stage and development possibilities of the Fischer-Tropsch-Synthesis for the production of primary chemicals and feedstocks
[BMFT-FB-T-77-43] N78-29581
RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
Information service planning and evaluation: A goal programming approach
[AD-A054108] N78-29968

S

SANDIA LABS., ALBUQUERQUE, N. MEX.
Entangled polymers: Polystyrene in butanone
[SAND-77-1734C] N78-29255
Kevlar 49-epoxy insulator
[SAND-77-0500] N78-29256
Reinforced elastomers and friction supports: Modern methods of antiseismic support
[SAND-78-6001] N78-29257
Ultrasonic attenuation as a function of heat treatment and grain size in 79Ni6Mo-15Fe alloy
[SAND-78-0144] N78-29280
Integrated circuits for managers
[SAND-77-0553C] N78-29378
Summary: Workshop on the DOE Combustion Diagnostics Facility
[SAND-77-8287] N78-29591
Diagnostics assessment for advanced power systems
[SAND-78-8206] N78-29603
Composite-rim flywheel design
[SAND-77-1061C] N78-29606
Slagging MHD generator: A parametric study
[SAND-77-1951] N78-29608
SCHAFER [W. J.] ASSOCIATES, INC., WAKEFIELD, MASS.
Laser driven light sails: An examination of the possibilities for interstellar probes and other missions
[NASA-CR-157362] N78-29117
SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Altitude decompression sickness: Review of concepts in primary care
[AD-A050849] N78-29737
Corneal damage thresholds for infrared laser exposure: Empirical data, model predictions, and safety standards
[AD-A049946] N78-29739
General strip chart plotting routine
[AD-A054156] N78-29801
Impact vulnerability of scratched glass lenses
[AD-A053421] N78-29904
SCIENCE APPLICATIONS, INC., ENGLEWOOD, COLO.
Man-machine interface analysis of the flight design system
[NASA-CR-151812] N78-29754
SCIENCE APPLICATIONS, INC., MCLEAN, VA.
Summary of field support for SAMS VI and MSV operations
[AD-A054343] N78-29128
SCIENCE APPLICATIONS, INC., SAN DIEGO, CALIF.
Mixing and combustion in high speed air flows
[AD-A054398] N78-29188
SCIENTIFIC TRANSLATION SERVICE, SANTA BARBARA, CALIF.
Computer program LK25OT: Power flux calculation and three-pole short circuit current calculation
[DOE-TR-77] N78-29380
SIEMENS A.G., ERLANGEN [WEST GERMANY].
Bioelectrodes as sensors and as power sources for implantable medical devices
[BMFT-FB-T-77-44] N78-29736
SMITHSONIAN INSTITUTION, EDGEWATER, MD.
Watershed Research in Eastern North America. Volume 1: A workshop to compare results
[PB-279919/5] N78-29549
Watershed Research in Eastern North America. Volume 2: A workshop to compare results
[PB-279920/3] N78-29550
SOLAR, SAN DIEGO, CALIF.
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-13] N78-29416
Development of a ceramic tube heat exchanger with relaxing joint
[FE-2556-14] N78-29417
SOLAR CONTROL CORP., BOULDER, COLO.
Installation package for 77-180 SOLARSTAT and 77-1 controller
[NASA-CR-150743] N78-29571
SOLAR ENERGY TECHNOLOGY, INC., BEDFORD, MASS.
Image collapsing concentrators
[ALO-33] N78-29600
SOLAREX CORP., ROCKVILLE, MD.
TDRSS system configuration study for space shuttle program
[NASA-CR-151751] N78-29140
SOUTHAMPTON UNIV. [ENGLAND].
The behaviour of centrifugal pumps operating with heavy oils
[ME/77/28] N78-29450
SOUTHERN METHODIST UNIV., DALLAS, TEX.
A new approach to ARMA modeling
N78-29814
Properties of ordinary and weighted least squares estimators of regression coefficients for two-stage samples
N78-29842
Thin film gallium arsenide solar cells and crystal structure determination by X-ray diffraction
N78-29953
SPAITE [PAUL W.] CO., CINCINNATI, OHIO.
Low- and medium-Btu gasification systems: Technology overview
[PB-279641/5] N78-29275
SPRINGBORN LABS., INC., ENFIELD, CONN.
Breadboard wash water renovation system
[NASA-CR-151818] N78-29993
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Tracking and monitoring hurricanes by HF skywave radar over the Gulf of Mexico
[AD-A053638] N78-29702
Evaluation of the FIB methodology for application to cloud motion wind data
[AD-A053620] N78-29703
HDM: Command and staff overview
[AD-A054482] N78-29803
STANFORD UNIV., CALIF.
Effect of chordwise forces and deformations and deformations due to steady lift on wing flutter
[AD-A053640] N78-29110
Creep of oxide dispersion strengthened materials [with special reference to TD nichrome]
[NASA-CR-135432] N78-29217
Facsimile communication and electronic mail system by satellite in Iran and other developing nations
N78-29301
The time-sequenced adaptive filter
N78-29343
KITCHIP: A superior low power monolithic device array
N78-29345
Implementation and error analysis in digital filters based on digital incremental computers
N78-29348
HCMM: Soil moisture in relation to geologic structure and lithology, Northern California
[E78-10177] N78-29533
Properties of spray pyrolysis CdS film and its application to thin film solar cell
N78-29565
Decomposition in fixed point computation
[AD-A053439] N78-29797
Convergence properties of a PIES-type algorithm for non-integrable functions
[AD-A053440] N78-29824
Phi sub p-optimal second order designs for symmetric regions
[AD-A053932] N78-29825
Strategies for conducting technology assessments
[PB-279471/7] N78-29973
Sources and characteristics of soluable organic nitrogen in activated-sludge effluents
N78-29991
STATE UNIV. OF NEW YORK, BUFFALO.
State estimation and optimal control of distributed parameter systems
N78-29177
STATE UNIV. OF NEW YORK AT BUFFALO.
Model studies of Lake Erie
N78-29528
Hydrodesulfurization and liquefaction of a bituminous coal in a batch autoclave with particulate and monolith catalysts
N78-29564
STATE UNIV. OF NEW YORK AT STONY BROOK.
Experimental study of the flow of drag reducing fluids in a narrow isosceles triangular duct
N78-29400
Aquatic disposal field investigations, Eatons Neck disposal site, Long Island Sound. Appendix B: Water-quality parameters and physicochemical sediment parameters
[AD-A053427] N78-29630
Concentration susceptibility and the phase diagram of He3-He4 mixtures near the tricritical line
N78-29932
Surface acoustic wave scattering from grooves in piezoelectric substrates
N78-29952
STEVENS, THOMPSON AND RUNYAN, INC., PORTLAND, OREG.
Package treatment plants: Operations manual
[PB-279444/4] N78-30004
Stabilization ponds: Operations manual
[PB-279443/6] N78-30005
STOCKHOLM UNIV. [SWEDEN].
Air chemistry measurements in the lower atmosphere made from a small aircraft - data presentation
[AC-42] N78-29692
STUTTGART UNIV. [WEST GERMANY].
On scattering diagnostics with periodically pulsed lasers to follow the continuous evolution of time dependent plasma parameters
[IPF-77-5] N78-29445
Plasma scattering experiments with a periodic Nd:YAG laser at 1.06 micron and a Si-avalanche detector
[IPF-78-2] N78-29446
Current and neutron yield scaling of fast high voltage plasma focus
[IPF-77-2] N78-29930
Beam deviation method as a diagnostic tool for the plasma focus
[IPF-78-3] N78-29931
SYRACUSE RESEARCH CORP., N. Y.
Adoption and utilization of urban technology: A decision-making study, analysis and conclusion, part 2
[PB-279541/7] N78-30010

SYSTEMS EXPLORATION, INC., SAN DIEGO, CALIF.
HF channel simulator for wide band signals. A mathematical model and computer program for 100-kHz bandwidth HF channels
[AD-A054726] N78-29323
SYSTEMS TECHNOLOGY, INC., MOUNTAIN VIEW, CALIF.
Simulation and analysis of wind shear hazard
[NASA-CR-157470] N78-29699

T

TECHNION - ISRAEL INST. OF TECH., HAIFA.
Rate theory of a two-dimensional elasto-plastic continuum
[TAE-303] N78-29502
TECHNISCHE HOCHSCHULE, DARMSTADT [WEST GERMANY].
Elastic-plastic crack closure analysis of Dugdale crack plates based on fatigue fracture mechanics
[REPT-30] N78-29489
TECHNISCHE HOGESCHOOL, DELFT [NETHERLANDS].
Non Hookean behavior in the fiber direction of carbon fiber composites and the influence of fiber waviness on the tensile properties
[VTH-LR-251] N78-29157
Notes on the unsteady rectilinear motion of a perfect gas. Part 3: Homogeneous solutions of the Lagrangian equations of motion
[VTH-LR-258] N78-29419
An experimental technique for vacuum infiltration of cracks with plastic and subsequent study in the scanning electron microscope
[VTH-LR-249] N78-29521
TECHNOLOGY, INC., DAYTON, OHIO.
An optimization study for generating surface-oriented coordinates for arbitrary bodies in high reflow
[AD-A054047] N78-29414
TENNESSEE TECHNOLOGICAL UNIV., COOKEVILLE.
Dipole array on a transmission line
[AD-A054315] N78-29370
TEXAS A&M UNIV., COLLEGE STATION.
Measurement of soil moisture trends with airborne scatterometers
[E78-10176] N78-29532
TEXAS ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS, AUSTIN.
Solid waste management: Implementing the Federal Resource Conservation and Recovery Act of 1976 in Texas
[PB-279311/5] N78-30007
TEXAS INSTRUMENTS, INC., DALLAS.
Laser rangefinder/tank thermal sight integration study
[AD-A054622] N78-29438
TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Properties of certain generalized power series distributions
N78-29841
Space-variant coherent optical processing
N78-29901
Plasma-laser interactions with solid poly-styrene microspheres
N78-29910
TEXAS UNIV., AUSTIN.
The effect of sample orientation on flame spread across polyurethane foams
N78-29181
Procedures for functional partitioning and simulation of large digital systems
N78-29347
Remote sensing of the earth's atmosphere by the use of radiation from ozone, oxygen and water vapor
N78-29530
Runge-Kutta formulas with extended regions of stability
N78-29818
TEXAS UNIV. AT AUSTIN.
Strength and behavior of anchor bolts embedded near edges of concrete piers
[PB-279376/8] N78-29278
Methodology for analyzing effects of urbanization on water resource systems
[PB-279663/9] N78-29557
Houston urban plume study: 1974, description and data
[PB-279409/7] N78-29658
TIMKEN CO., CANTON, OHIO.
Tapered roller bearing development for aircraft turbine engines
[AD-A054045] N78-29458
TRANSPORTATION RESEARCH BOARD, WASHINGTON, D. C.
Design and performance of pavement overlays
[PB-279523/5] N78-29284
Urban transportation economics: Proceedings of five workshops on pricing alternatives, economic regulations, labor issues, marketing, and government financing responsibilities
[PB-279689/4] N78-30009
TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
Bibliography and comments on Loran-C ground wave propagation
[PB-279463/4] N78-29079
TRW DEFENSE AND SPACE SYSTEMS GROUP, HOUSTON, TEX.
Concepts and requirements for shuttle/payload orbital operations of the space transportation system
[NASA-CR-151808] N78-29143
TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Modeling and Analysis of Power Processing Systems [MAPPS], initial phase 2
[NASA-CR-135173] N78-29350
Modelling, analyses and design of switching converters
[NASA-CR-135174] N78-29351
CTS TEP thermal anomalies: Heat pipe system performance
[NASA-CR-159413] N78-29410
TULSA UNIV., OKLA.
Computer simulation of non-Darcy two-phase flow in oil reservoirs
N78-29405

U

UNION COLL., SCHENECTADY, N.Y.
Confidence limits on MTBF for sequential test plans of MIL-STD 781
[AD-A054588] N78-29482
Moving average models: Time series in M-dimensions
[AD-A054585] N78-29849
Time series in M dimensions: Definition, problems and prospects
[AD-A054584] N78-29850
Time series in M dimensions: Autoregressive models
[AD-A054586] N78-29851
Interrelationships between autoregressive and moving average models - the ARMA model: General considerations in M dimensions
[AD-A054587] N78-29852
UNIVERSITY COLL., CORK [IRELAND].
The edge-function method [E.F.M.]
[AD-A054265] N78-29827
UNIVERSITY OF SOUTHERN CALIF., LOS ANGELES.
Image understanding research
[AD-A054091] N78-29329
Estimation and identification for modeling dynamic systems
[AD-A053583] N78-29826
UNIVERSITY OF SOUTHERN CALIF., MARINA DEL REY.
HP/MME terminal: Application specification
[AD-A054722] N78-29774
UTAH DEPT. OF TRANSPORTATION, SALT LAKE CITY.
Deicing-chemical rates on open-graded pavements: Studies in Maine, Michigan, Utah, and Vermont
[PB-279224/0] N78-29293
UTAH STATE UNIV., LOGAN.
Design automation and testing of diagnosable MOS combinational logic networks
N78-29344
UTAH UNIV., SALT LAKE CITY.
Interaction of water with hydrophilic methacrylate polymers
N78-29244
An investigation of the growth and decay of long and synoptic-scale waves
N78-29294
Object models for computer aided design
N78-29765

V

VEREINIGTE FLUGTECHNISCHE WERKE-FOKKER G.M.B.H., BREMEN [WEST GERMANY].
Calculation of the interference between civil-military transport aircraft engine and basis wing according to the vortex conductor procedure
[DLR-IB-151-77/19] N78-29075
VERMONT DEPT. OF HIGHWAYS, MONTPELIER.
Deicing-chemical rates on open-graded pavements: Studies in Maine, Michigan, Utah, and Vermont
[PB-279224/0] N78-29293
VERMONT UNIV., BURLINGTON.
Synthesis, magnetic susceptibility, and Moessbauer spectra of Fe[III] dimers and Fe[II] polymers containing 2,5-dihydroxy-1,4-benzoquinones
[AD-A054678] N78-29250
VERSAR, INC., SPRINGFIELD, VA.
Evaluation of a technique for sampling low concentrations of organic vapors in ambient air
[PB-279672/0] N78-29652
VIRGINIA HIGHWAY AND TRANSPORTATION RESEARCH COUNCIL, CHARLOTTESVILLE.
The applicability of infrared thermography in the detection of delamination in bridge decks
[PB-279508/6] N78-29285
VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Phytoplankton sampling in quantitative baseline and monitoring programs
[PB-279644/9] N78-29733
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Theoretical-experimental correlation for buckling of composite cylinders under combined compression and torsion
[NASA-CR-157358] N78-29503
VIRGINIA UNIV., CHARLOTTESVILLE.
Demand modelling of passenger air travel: An analysis and extension. Volume 1: Background and summary
[NASA-CR-157469] N78-29076
Seagrass literature survey
[AD-A054480] N78-29729

W

WASHINGTON STATE UNIV., PULLMAN.
Electrical response of a bimetallic junction to shock compression
[AD-A053693] N78-29362
Energy conservation policy evaluation. Study module 1A, volume 2: Technical appendix
[PB-279664/7] N78-29620
WASHINGTON UNIV., SEATTLE.
Sediment and water quality: A review of the literature including a suggested approach for water quality criteria with summary of workshop and conclusions and recommendations
[PB-279469/1] N78-29646
Coastal upwelling ecosystems analysis. JOINT-II, the Thompson sections: R/V T. G. Thompson cruise 108
[PB-279173/9] N78-29718
Deep ocean mining and the ecology of the tropical north Pacific
[PB-279988/0] N78-29722
WATERLOO UNIV. [ONTARIO].
The finite element method applied to a class of time-dependent nonlinear partial differential equations
[TN-21] N78-29819
WEBB INST. OF NAVAL ARCHITECTURE, GLEN COVE, N.Y.
Possible future marine fuels
[PB-279257/0] N78-29274
WEST VIRGINIA UNIV., MORGANTOWN.
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 1: Main report
[PB-279512/8] N78-29282
An investigation of the parameters influencing bond behavior with a view towards establishing design criteria. Volume 2: Appendix
[PB-279513/6] N78-29283
WESTINGHOUSE DEFENSE AND ELECTRONIC SYSTEMS CENTER, BALTIMORE, MD.
Communications Link Characterization Experiment [CLCE]
[NASA-CR-156784] N78-29308
MNOS BORAM manufacturing methods and technology project
[AD-A054481] N78-29373
WESTINGHOUSE ELECTRIC CORP., BALTIMORE, MD.
Communications Link Characterization Experiment [CLCE], volume 3
[NASA-CR-156801] N78-29306
WESTINGHOUSE ELECTRIC CORP., HORSEHEADS, N. Y.
Manufacturing methods and engineering for TFT addressed display
[AD-A054273] N78-29368
WESTINGHOUSE ELECTRIC CORP., MADISON, PA.
Effects of geometric nonuniformities on the stresses in piping elbows
[WARD-SD-3045-7] N78-29513
WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Nuclear Bi-Brayton system for aircraft propulsion study
[AD-A054672] N78-29106
Development of pumps for pulse compression laser applications
[AD-A054223] N78-29440
Development of an iron-air battery system for electric vehicles
[TID-27914] N78-29604
WESTON ENVIRONMENTAL CONSULTANTS-DESIGNERS, WEST CHESTER, PA.
Multiple water supply approach for urban water management
[PB-279768/6] N78-30011

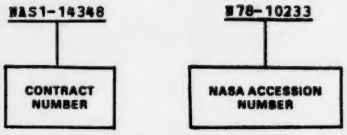
WHITE SANDS MISSILE RANGE, N.MEX.
Concepts in real-time video tracking
[AD-A054475] N78-29320
WISCONSIN UNIV. - MADISON.
Chemical reactions and properties of organosilicon compounds related to new materials
[AD-A053672] N78-29150
Planning in interconnected power systems: An example of two-stage programming under uncertainty
[AD-A054554] N78-29376
Photoabsorption and photoionization measurements on constituent atmospheric gases in the extreme VUV
N78-29661
A test of a cognitive model of computer program readability
N78-29768
A design for machine learning during continuous interaction with a simulated environment
N78-29771
Automatic differentiation of computer programs and a posteriori error bounds for two-point boundary value problems
N78-29786
Analysis of evolutionary error in finite element and other methods
[AD-A054551] N78-29828
A posteriori error bounds for two-point value problems
[AD-A054544] N78-29831
An integral representation for eigenfunctions of linear ordinary differential operators
[AD-A054543] N78-29832
Relations among generalized Korteweg-DeVries systems
[AD-A054542] N78-29833
Some optimal properties and interpretations of principal components
[AD-A054555] N78-29834
A set of orthogonal polynomials that generalize the racah coefficients or 6 -J symbols
[AD-A054552] N78-29835
Uniqueness of solutions to hyperbolic conservation laws
[AD-A054557] N78-29836
Quadratic interpolation is risky
[AD-A054558] N78-29837
Studies in the analysis of serially dependent data
[AD-A054556] N78-29838
Adaptive minimum mean square error forecast of missile trajectory using stochastic difference equation models
[AD-A054540] N78-29846
A Fubini theorem for iterated stochastic integrals
[AD-A054545] N78-29847
The use of stochastic programming for the solution of some problems in statistics and probability
[AD-A054553] N78-29848
Approximation of convex set-valued functions
[AD-A054541] N78-29861
Strong convergence of semigroups of nonlinear contractions in Hilbert space
[AD-A054547] N78-29862
A variational equivalent to diagonal scaling
[AD-A054548] N78-29863
The dissipative trapped electron instability in the linear multi-mirror device N78-29909
WISCONSIN UNIV., MADISON.
Mathematical theory of laminar combustion. 3: Perturbations
[AD-A054538] N78-29189
Mathematical theory of laminar combustion. 2: The premixed plane flame
[AD-A054537] N78-29190
Fluid motion in packed bed reactors
N78-29406
The use of satellite imagery for lake classification in Wisconsin
[PB-279628/2] N78-29558
Fast Poisson solvers on general two dimensional regions for the Dirichlet problem
[AD-A054539] N78-29830
WYOMING UNIV., LARAMIE.
Assessment of atmospheric condensation nuclei associated with jet aircraft traffic
[AD-A054319] N78-29705

X

XEROX ELECTRO-OPTICAL SYSTEMS, PASADENA, CALIF.
Thermal energy storage demonstration unit for Vuilleumier cryogenic cooler
[AD-A054466] N78-29589

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 627A
N78-29128
N78-29136
AF PROJ. 649L
N78-29374
AF PROJ. 1367
N78-29087
AF PROJ. 1476
N78-29415
AF PROJ. 1900
N78-29261
AF PROJ. 1959
N78-29756
AF PROJ. 2037
N78-29152
AF PROJ. 2304
N78-29315
N78-29317
N78-29811
N78-29812
N78-29821
N78-29823
N78-29826
AF PROJ. 2305
N78-29800
AF PROJ. 2307
N78-29071
N78-29107
AF PROJ. 2311
N78-29678
N78-30030
AF PROJ. 2338
N78-29365
AF PROJ. 2611
N78-29907
AF PROJ. 4519
N78-29319
AF PROJ. 4594
N78-29773
AF PROJ. 6319
N78-29801
AF PROJ. 7231
N78-29872
N78-29873
AF PROJ. 7661
N78-29366
AF-AFOSR-2611-74
N78-29315
AF-AFOSR-2615-74
N78-29220
AF-AFOSR-2642-74
N78-29812
AF-AFOSR-2644-74
N78-29150
AF-AFOSR-2671-74
N78-29821
AF-AFOSR-2768-75
N78-29827
AF-AFOSR-2789-75
N78-29251
AF-AFOSR-2797-75
N78-29826
AF-AFOSR-2840-75
N78-29811
AF-AFOSR-2878-76
N78-29822
AF-AFOSR-2900-76
N78-29749
N78-29755
AF-AFOSR-2936-76
N78-29184
AF-AFOSR-3092-76
N78-29823
AF-AFOSR-3156-77
N78-29317
AF-AFOSR-3181-77
N78-29795
AF-AFOSR-3191-77
N78-29413
AF-AFOSR-3271-77
N78-29790
AF-AFOSR-3350-77
N78-29758
AF-AFOSR-3378-77
N78-29370
ARPA ORDER 2223
N78-29774
ARPA ORDER 2397
N78-29488
ARPA ORDER 3045
N78-29318
ARPA ORDER 3231
N78-29364
ARPA ORDER 3359
N78-29707
ARPA ORDER 3491
N78-29796
AT(29-1)-789 N78-29378
C-5-35616 N78-29336
DA PROJ. 1L1-61102-AH-60
N78-29249
DA PROJ. 1L1-61102-B-53A
N78-29682
DA PROJ. 1L1-62705-AH-94
N78-29369
DA PROJ. 1N3-62303-A-214
N78-29322
DA PROJ. 1T1-61101-A-91A
N78-29740
DA PROJ. 1T1-62105-AH-84
N78-29455
N78-29959
DA PROJ. 1T6-65702-D-127
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N78-29190
N78-29376
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N78-29846
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DAAG29-76-C-0052
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DAAG29-76-D-0100
N78-29508
DAAG29-77-G-0031
N78-29825
DAAG29-77-G-0191
N78-29359
DAAJ01-71-C-0840
N78-29089
N78-29094
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DAAK40-74-C-0853
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DAAK70-77-C-0153
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DACW17-75-C-0075
N78-29985
DACW39-74-C-0170
N78-29729
DACW51-75-C-0016
N78-29630
DAHC15-72-C-0308
N78-29774
DCA100-76-C-0089
N78-29313
DI-14-08-0001-15893
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DI-14-08-0001-16711
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DI-14-08-0001-16719
N78-29664
DI-14-31-0001-4209
N78-29645
DI-14-34-0001-5050
N78-29558
DI-14-34-0001-6052
N78-29558
DI-14-34-0001-6064
N78-29554
DI-14-34-0001-6236
N78-29619
DI-14-34-0001-7092
N78-29557
DNA-IACRO-77-828
N78-29685
DNA001-75-C-0035
N78-29321
DNA001-76-C-0135
N78-29324
DNA001-77-C-0202
N78-29683
DOT-FA75WA-3703
N78-29628
N78-29629
DOT-FA75WA-3707
N78-29084
N78-29085
DOT-FH-11-7730
N78-29657
DOT-FH-11-9212
N78-29293
DOT-HS-6-01427
N78-29468
DOT-OS-40018 N78-29467
N78-29525
DOT-TSC-1078 N78-30006
E(11-1)-2570 N78-29151
E(49-20)-1006
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E(49-26)-1022
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E(49-28)-1022
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EC-77-A-31-1011
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EC-77-S-02-4288
N78-29607
EF-77-A-01-2593
N78-29216
EF-77-C-01-2556
N78-29416
N78-29417
EG-77-C-01-4007
N78-29592
EG-77-G-04-4163
N78-29600
EG-77-S-02-4264
N78-29805
EPA-R-803473 N78-29654
EPA-R-803660 N78-29658
EPA-R-804147-01-0
N78-29733
EPA-S-803151 N78-30008
EPA-68-01-2430
N78-29640
N78-29641
N78-29653
EPA-68-01-3547
N78-30004
N78-30005
EPA-68-01-3586
N78-29553
EPA-68-01-4418
N78-30003
EPA-68-01-4424
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EPA-68-01-4477
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EPA-68-02-1226
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EPA-68-02-2618
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EPA-68-03-2056
N78-29286
EPRI PROJ. RP652-1
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EPRI PROJ. 652-1
N78-29797
EPRI PROJ. 919-1
N78-29596
EPRI PROJ. 1012-1
N78-29602
EX-76-C-01-1827
N78-29381
EX-76-C-01-2457
N78-29595
EY-76-C-02-0016
N78-29594
N78-29611
N78-29635
N78-29895
N78-29896
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N78-29898
EY-76-C-02-2949
N78-29604
EY-76-C-02-3045-032
N78-29513
EY-76-C-03-0167-038
N78-29919
N78-29920
N78-29922
EY-76-C-03-0700
N78-29460
EY-76-C-04-0789
N78-29255
N78-29256
N78-29280
N78-29378
N78-29591
N78-29603
N78-29606
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EY-76-C-04-3533
N78-29459
EY-76-C-06-1830
N78-29612
EY-76-C-11-0014
N78-29515
EY-76-C-0167-038
N78-29923
EY-76-S-02-2570
N78-29151
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N78-29598
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EY-76-S-06-2439
N78-29590
EY-77-C-03-0167-038
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EY-77-C-06-1030
N78-29192
FHV-F-INK-82223-75-007-07-001
N78-29462
FHV-FK-82223-75-007-001
N78-29522
FHV-FK-82223-75-083-07-001
N78-29523
F04606-76-A-0087
N78-29098
F04701-74-C-0542
N78-29360
F04701-77-C-0078
N78-29129
N78-29137
F04701-77-C-0090
N78-29844
F04701-77-C-0152
N78-29325
F19628-76-C-0007
N78-29907
F19628-76-C-0131
N78-29128
F19628-76-C-0248
N78-29366
F19628-77-C-0008
N78-29678
F19628-77-C-0019
N78-29680
F19628-77-C-0189
N78-30029
F19628-78-C-002
N78-29374
F19628-78-C-0002
N78-29326
N78-29328
F29601-76-C-0015
N78-29681
F30602-75-C-0118
N78-29355
N78-29356
N78-29357
F30602-76-C-0126
N78-29799
F30602-76-C-0361
N78-29319
F30602-76-C-0395
N78-29365
F30602-76-C-0445
N78-29776
F30602-77-C-0030
N78-29773
F33615-72-C-1288
N78-29221
F33615-73-C-4155
N78-29414
F33615-74-C-2068
N78-29109
F33615-74-C-4073
N78-29252
F33615-75-C-2035
N78-29108
F33615-75-C-2045
N78-29589
F33615-75-C-3105
N78-29372
F33615-75-C-5095
N78-29253
F33615-75-C-5224
N78-29509
F33615-76-C-0608
N78-29738
F33615-76-C-1203
N78-29329
F33615-76-C-2019
N78-29458
F33615-76-C-3067
N78-29071
F33615-76-C-3133
N78-29095
F33615-76-C-3145
N78-29414
F33615-76-C-5111
N78-29457
F33615-77-C-0016
N78-29756
N78-29757
F33615-77-C-0116
N78-29106
F33615-77-C-1016
N78-29329
F33615-77-C-5124
N78-29153
F44620-74-C-0059
N78-29412
F44620-76-C-0033
N78-29892
F44620-76-C-0043
N78-29800
F44620-76-C-0049
N78-29069
F49620-76-C-0023
N78-29702
F49620-77-C-0034
N78-29362
F49620-77-C-0044
N78-29188
F49620-77-C-0066
N78-29107
F49620-77-C-0072
N78-29248
GA PROJ. 3235
N78-29919
N78-29923
JPL-64598 N78-29664
JPL-954547 N78-29697
JPL-954663 N78-29674
JPL-954880 N78-29131
LA PROJ. E-736
N78-29919
NA-3-36208 N78-29234
NDA903-78-C-0129
N78-29796
NIPR-FY1457-76-00451
N78-29253
NASA ORDER P-57606-G
N78-29127
NASA ORDER 67705-C
N78-29408
N78-29409
NASW-2792 N78-29535
NASW-2961 N78-29045
NASW-3098 N78-29118
NAS1-13175 N78-29503
NAS1-13624 N78-29082
N78-29083
NAS1-14678 N78-29426
NAS1-14741 N78-29050
NAS1-14743 N78-29049
NAS1-14744 N78-29052
NAS1-14909 N78-29119
N78-29120
N78-29121
N78-29122
NAS2-8889 N78-29699
NAS2-9814 N78-29995
N78-29996
NAS2-9816 N78-29146
NAS3-17866 N78-29867
N78-29868
N78-29869
NAS3-18917 N78-29147
NAS3-19427 N78-29449
NAS3-19690 N78-29350
N78-29351
NAS3-20070 N78-29099
NAS3-20102 N78-29351
NAS3-20108 N78-29574
NAS3-20592 N78-29584
NAS3-20595 N78-29992
NAS3-20631 N78-29103
NAS3-20632 N78-29105
NAS3-21012 N78-29410
NAS3-21041 N78-29104
NAS3-21054 N78-29276
NAS4-2391 N78-29101
N78-29102
NAS5-20729 N78-29306
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NAS5-20738 N78-29304
NAS5-20834 N78-30026
NAS5-22575 N78-29134
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N78-29668
NAS5-24252 N78-29309
NAS5-24479 N78-29533
NAS7-100 N78-29674
N78-29697
NAS8-31036 N78-29183
NAS8-31470 N78-29123
NAS8-31993 N78-29116
NAS8-32253 N78-29570
NAS8-32256 N78-29579
NAS8-32257 N78-29580
NAS8-32258 N78-29571
NAS8-32353 N78-29182
NAS8-32641 N78-29352
NAS9-11845 N78-29302
NAS9-14000 N78-29141
N78-29144
NAS9-14095 N78-29142
NAS9-14632 N78-29724
NAS9-14723 N78-29143
NAS9-15196 N78-29133
NAS9-15200 N78-29791
N78-29794
NAS9-15286 N78-29567
NAS9-15303 N78-29140
NAS9-15323 N78-29424
NAS9-15369 N78-29993
NAS9-15504 N78-29723
NAS9-15535 N78-29754
NAS9-15579 N78-29145
NBS-6-13980 N78-29289
NGL-05-002-069
N78-29673
NGL-05-002-105
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N78-29110
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NGL-21-002-033
N78-30027
NGL-34-001-001
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NGL-44-005-084
N78-29820
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N78-29217
NGR-06-002-147
N78-29916
NGR-14-005-181
N78-29665
NGR-33-008-199
N78-30028
NGR-33-010-188
N78-29911
NGR-34-002-195
N78-29585
NIVR-1782 N78-29331
NOAA-03-06-022-35117
N78-29722
NR PROJ. 042-267
N78-29825
NR PROJ. 042-269
N78-29811
NR PROJ. 056-651
N78-29894
NR PROJ. 062-558
N78-29411
NR PROJ. 318-009
N78-29957
NR PROJ. 359-653
N78-29961
NSF AER-73-03259-A03
N78-29273
NSF AER-76-12283
N78-29988
NSF C-DS172-02700-A17
N78-29982
NSF C-76-22517
N78-29713
NSF C-310 N78-29715
NSF C-1007 N78-29976
NSF DES-75-03643
N78-29675
NSF DES-75-10719
N78-29706
NSF DMR-76-81083
N78-29911
NSF ENV-74-13016
N78-30001
NSF ENV-74-24271
N78-29549
N78-29550
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N78-30011
NSF ENV-76-22045
N78-29550
NSF ERS-75-22788
N78-29973
NSF GA-42159 N78-29107
NSF GN-27458 N78-29975
NSF GN-042305
N78-29980
NSF MCS-74-20584
N78-29837

NSF ECS-75-17385
N78-29832
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N78-29847
N78-29863
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N78-29823
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N78-29824
NSF ECS-77-05623
N78-29797
NSF ECS-77-09574
N78-29834
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NSG-1139 N78-29086
NSG-1425 N78-29568
NSG-1448 N78-30022
NSG-5093 N78-29303
NSG-5134 N78-29532
NSG-5200 N78-29539
NSG-5224 N78-29664
NSG-7266 N78-29076
NSG-7369 N78-29131
N78-29132
NSR-09-051-001
N78-29663
N00014-68-C-1183
N78-29318
N00014-67-A-0321-0006
N78-29811
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N78-29070
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N00014-75-C-0865
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N78-29187
N00014-75-C-1143
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N00014-76-C-0215
N78-29454
N00014-76-C-0326
N78-29829
N00014-76-C-0368
N78-29957
N00014-76-C-0475
N78-29825
N00014-76-C-0554
N78-29586
N00014-76-C-0935
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N78-29894
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N78-29961
N00014-77-C-0438
N78-29482
N78-29849
N78-29850
N78-29851
N78-29852
N00014-77-C-0488
N78-29219
N00017-73-C-1418
N78-29222
N00019-76-C-0510
N78-29260
N00019-77-C-0327
N78-29958
N00024-76-C-5366
N78-29956
N00039-76-C-0141
N78-29363
N00123-76-C-0195
N78-29803
N00123-76-C-1090
N78-29323
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N78-29364
N00173-76-C-8183
N78-29997
N00228-76-C-3182
N78-29703
N68305-77-C-0009
N78-29277
OWRT PROJ. A-062-WIS(1)
N78-29558
PROJ. E-16-681
N78-29590
PROJ. SQUID N78-29088
N78-29185
PROJ. 2738 N78-29424
PROJ. 6037.6 N78-29993
RF21211401 N78-29775
RR0110941 N78-29893
SF54591501 N78-29361
SRI PROJ. 4828
N78-29803
SRI PROJ. 5630
N78-29702
SWED-EPB-7-151/75
N78-29692
SWED-EPB-7-151/76
N78-29692
W-31-109-ENG-38
N78-29510
W-7405-ENG-26
N78-29576
N78-29742
N78-29926
N78-29962
W-7405-ENG-36
N78-29191
N78-29279
N78-29429
N78-29443
N78-29514
N78-29546
N78-29547
N78-29760
N78-29777
N78-29778
N78-29804
N78-29919
N78-29927
N78-29928
W-7405-ENG-48
N78-29155
N78-29156
N78-29225
N78-29226
N78-29379
N78-29408
N78-29409
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N78-29688
N78-29925
N78-29998
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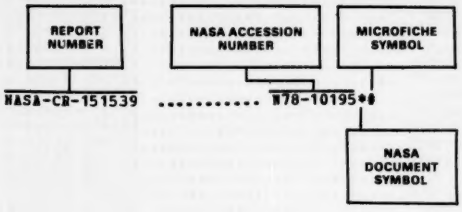
XF52552701 N78-29875
YF54593012 N78-29247
ZF11121003 N78-29874
ZF54595001 N78-29905
ZF57571001 N78-29588
Z99QAXTB087 N78-29359
505-06-11 N78-29067
505-06-11-06-00-21
N78-29451
506-15-21 N78-29149
506-16-41-02 N78-29436
516-50-23-01 N78-29046
992-01-00 N78-29843
992-21-01 N78-29044
992-22-08 N78-29068

REPORT / ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



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A-6865 ..... N78-29436*#
A-7394 ..... N78-29067*#
A-7430 ..... N78-29044*#
A-7464 ..... N78-29068*#
A-7503 ..... N78-29451*#
A-7537 ..... N78-29149*#

AC-42 ..... N78-29692 #

AD-A049171 ..... N78-29628 #
AD-A049300 ..... N78-29629 #
AD-A049946 ..... N78-29739 #
AD-A050483 ..... N78-29137 #
AD-A050849 ..... N78-29737 #
AD-A050921 ..... N78-29111 #
AD-A050963 ..... N78-29740 #
AD-A050971 ..... N78-29749 #
AD-A050972 ..... N78-29755 #
AD-A051138 ..... N78-30029 #
AD-A052435 ..... N78-29699*#
AD-A053024 ..... N78-29586 #
AD-A053373 ..... N78-29260 #
AD-A053374 ..... N78-29750 #
AD-A053402 ..... N78-29474 #
AD-A053403 ..... N78-29475 #
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AD-A053405 ..... N78-29470 #
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AD-A053407 ..... N78-29473 #
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AD-A053410 ..... N78-29481 #
AD-A053411 ..... N78-29476 #
AD-A053412 ..... N78-29477 #
AD-A053413 ..... N78-29478 #
AD-A053414 ..... N78-29480 #
AD-A053415 ..... N78-29479 #
AD-A053416 ..... N78-29738 #
AD-A053417 ..... N78-29088 #
AD-A053421 ..... N78-29904 #
AD-A053422 ..... N78-29727 #
AD-A053423 ..... N78-29089 #
AD-A053427 ..... N78-29630 #
AD-A053431 ..... N78-29679 #
AD-A053435 ..... N78-29728 #
AD-A053439 ..... N78-29797 #
AD-A053440 ..... N78-29824 #
AD-A053444 ..... N78-29316 #
AD-A053445 ..... N78-29090 #
AD-A053447 ..... N78-29097 #
AD-A053449 ..... N78-29874 #
AD-A053450 ..... N78-29796 #
AD-A053451 ..... N78-29680 #
AD-A053452 ..... N78-29277 #
AD-A053456 ..... N78-29361 #
AD-A053539 ..... N78-29359 #
AD-A053548 ..... N78-29355 #
AD-A053557 ..... N78-29247 #
AD-A053558 ..... N78-29312 #
AD-A053559 ..... N78-29356 #
AD-A053560 ..... N78-29357 #
AD-A053561 ..... N78-29365 #
AD-A053564 ..... N78-29367 #
AD-A053567 ..... N78-29701 #
AD-A053568 ..... N78-29704 #
AD-A053579 ..... N78-29186 #
AD-A053581 ..... N78-29219 #
AD-A053583 ..... N78-29826 #
AD-A053588 ..... N78-29087 #
AD-A053617 ..... N78-29091 #
AD-A053618 ..... N78-29366 #
AD-A053620 ..... N78-29703 #
AD-A053621 ..... N78-29587 #
AD-A053622 ..... N78-29364 #
AD-A053623 ..... N78-29313 #
AD-A053624 ..... N78-29314 #
AD-A053627 ..... N78-29358 #
AD-A053629 ..... N78-29795 #
AD-A053633 ..... N78-29821 #
AD-A053634 ..... N78-29315 #
AD-A053635 ..... N78-29184 #
AD-A053637 ..... N78-29892 #
AD-A053638 ..... N78-29702 #
AD-A053640 ..... N78-29110*#
AD-A053643 ..... N78-29726 #
AD-A053646 ..... N78-29453 #
AD-A053647 ..... N78-29678 #
AD-A053649 ..... N78-29220 #
AD-A053651 ..... N78-29822 #
AD-A053652 ..... N78-29997 #
AD-A053654 ..... N78-29136 #
AD-A053656 ..... N78-29112 #
AD-A053657 ..... N78-29903 #
AD-A053672 ..... N78-29150 #
AD-A053680 ..... N78-29757 #
AD-A053681 ..... N78-29756 #
AD-A053684 ..... N78-29799 #
AD-A053685 ..... N78-29319 #
AD-A053690 ..... N78-29985 #
AD-A053691 ..... N78-29069 #
AD-A053692 ..... N78-29413 #
AD-A053693 ..... N78-29362 #
AD-A053694 ..... N78-29681 #
AD-A053695 ..... N78-29185 #
AD-A053699 ..... N78-29872 #
AD-A053702 ..... N78-29873 #
AD-A053715 ..... N78-29363 #
AD-A053732 ..... N78-29905 #
AD-A053737 ..... N78-29318 #
AD-A053738 ..... N78-29823 #
AD-A053739 ..... N78-29360 #
AD-A053741 ..... N78-29798 #
AD-A053742 ..... N78-29152 #
AD-A053743 ..... N78-29221 #
AD-A053744 ..... N78-29412 #
AD-A053745 ..... N78-29222 #
AD-A053759 ..... N78-29893 #
AD-A053804 ..... N78-29810 #
AD-A053858 ..... N78-29961 #
AD-A053877 ..... N78-29507 #
AD-A053901 ..... N78-29317 #
AD-A053932 ..... N78-29825 #
AD-A053986 ..... N78-29811 #
AD-A054008 ..... N78-29545 #
AD-A054021 ..... N78-29327 #
AD-A054023 ..... N78-29509 #
AD-A054024 ..... N78-29094 #
AD-A054025 ..... N78-29455 #
AD-A054026 ..... N78-29456 #
AD-A054033 ..... N78-29328 #
AD-A054036 ..... N78-29071 #
AD-A054042 ..... N78-29457 #
AD-A054043 ..... N78-29252 #
AD-A054044 ..... N78-29253 #
AD-A054045 ..... N78-29458 #
AD-A054047 ..... N78-29414 #
AD-A054048 ..... N78-29095 #
AD-A054061 ..... N78-29802 #

AD-A054091 ..... N78-29329 #
AD-A054101 ..... N78-30030 #
AD-A054102 ..... N78-29093 #
AD-A054105 ..... N78-29894 #
AD-A054108 ..... N78-29968 #
AD-A054113 ..... N78-29428 #
AD-A054149 ..... N78-29437 #
AD-A054156 ..... N78-29801 #
AD-A054157 ..... N78-29077 #
AD-A054160 ..... N78-29326 #
AD-A054173 ..... N78-29107 #
AD-A054177 ..... N78-29371 #
AD-A054179 ..... N78-29251 #
AD-A054189 ..... N78-29775 #
AD-A054194 ..... N78-29261 #
AD-A054208 ..... N78-29707 #
AD-A054214 ..... N78-29845 #
AD-A054215 ..... N78-29588 #
AD-A054216 ..... N78-29741 #
AD-A054217 ..... N78-29686 #
AD-A054223 ..... N78-29440 #
AD-A054224 ..... N78-29441 #
AD-A054225 ..... N78-29372 #
AD-A054265 ..... N78-29827 #
AD-A054266 ..... N78-29085 #
AD-A054273 ..... N78-29368 #
AD-A054287 ..... N78-29800 #
AD-A054302 ..... N78-29706 #
AD-A054308 ..... N78-29773 #
AD-A054313 ..... N78-29812 #
AD-A054315 ..... N78-29370 #
AD-A054316 ..... N78-29958 #
AD-A054317 ..... N78-29084 #
AD-A054319 ..... N78-29705 #
AD-A054320 ..... N78-29454 #
AD-A054325 ..... N78-29684 #
AD-A054328 ..... N78-29249 #
AD-A054329 ..... N78-29223 #
AD-A054330 ..... N78-29508 #
AD-A054341 ..... N78-29129 #
AD-A054342 ..... N78-29248 #
AD-A054343 ..... N78-29128 #
AD-A054349 ..... N78-29070 #
AD-A054359 ..... N78-29321 #
AD-A054360 ..... N78-29683 #
AD-A054361 ..... N78-29685 #
AD-A054371 ..... N78-29875 #
AD-A054372 ..... N78-29427 #
AD-A054376 ..... N78-29682 #
AD-A054394 ..... N78-29153 #
AD-A054396 ..... N78-29844 #
AD-A054397 ..... N78-29957 #
AD-A054398 ..... N78-29188 #
AD-A054413 ..... N78-29918 #
AD-A054416 ..... N78-29092 #
AD-A054417 ..... N78-29876 #
AD-A054418 ..... N78-29369 #
AD-A054419 ..... N78-29960 #
AD-A054424 ..... N78-29224 #
AD-A054428 ..... N78-29959 #
AD-A054462 ..... N78-29415 #
AD-A054464 ..... N78-29109 #
AD-A054465 ..... N78-29262 #
AD-A054466 ..... N78-29589 #
AD-A054475 ..... N78-29320 #
AD-A054476 ..... N78-29375 #
AD-A054477 ..... N78-29907 #
AD-A054478 ..... N78-29374 #
AD-A054480 ..... N78-29729 #
AD-A054481 ..... N78-29373 #
AD-A054482 ..... N78-29803 #
AD-A054483 ..... N78-29829 #
AD-A054508 ..... N78-29776 #
AD-A054509 ..... N78-29254 #
AD-A054533 ..... N78-29108 #
AD-A054537 ..... N78-29190 #
AD-A054538 ..... N78-29189 #
AD-A054539 ..... N78-29830 #
AD-A054540 ..... N78-29846 #
AD-A054541 ..... N78-29861 #
AD-A054542 ..... N78-29833 #
AD-A054543 ..... N78-29832 #
AD-A054544 ..... N78-29831 #
AD-A054545 ..... N78-29847 #
AD-A054547 ..... N78-29862 #
AD-A054548 ..... N78-29863 #
AD-A054551 ..... N78-29828 #
AD-A054552 ..... N78-29835 #
AD-A054553 ..... N78-29848 #
AD-A054554 ..... N78-29376 #
AD-A054555 ..... N78-29834 #
AD-A054556 ..... N78-29838 #
AD-A054557 ..... N78-29836 #
AD-A054558 ..... N78-29837 #
AD-A054562 ..... N78-29377 #
AD-A054584 ..... N78-29850 #
AD-A054585 ..... N78-29849 #
AD-A054586 ..... N78-29851 #
AD-A054587 ..... N78-29852 #
AD-A054588 ..... N78-29482 #
AD-A054622 ..... N78-29438 #
AD-A054634 ..... N78-29631 #
AD-A054637 ..... N78-29154 #
AD-A054672 ..... N78-29106 #
AD-A054674 ..... N78-29187 #
AD-A054675 ..... N78-29439 #
AD-A054676 ..... N78-29758 #
AD-A054677 ..... N78-29324 #
AD-A054678 ..... N78-29250 #
AD-A054703 ..... N78-29325 #
AD-A054706 ..... N78-29906 #
AD-A054719 ..... N78-29098 #
AD-A054720 ..... N78-29113 #
AD-A054722 ..... N78-29774 #
AD-A054726 ..... N78-29323 #
AD-A054727 ..... N78-29322 #
AD-A054728 ..... N78-29956 #
AD-A054796 ..... N78-29078 #

AD-E000152 ..... N78-29875 #
AD-E000155 ..... N78-29154 #
AD-E000160 ..... N78-29631 #
AD-E100049 ..... N78-29313 #
AD-E300113 ..... N78-29223 #
AD-E300199 ..... N78-29685 #
AD-E300202 ..... N78-29683 #
AD-E300204 ..... N78-29321 #
AD-E430011 ..... N78-29508 #
AD-E430012 ..... N78-29427 #
AD-E430016 ..... N78-29249 #
AD-E430022 ..... N78-29682 #

AEDC-TR-78-20 ..... N78-29876 #

AES-7801 ..... N78-29850 #
AES-7802 ..... N78-29849 #
AES-7803 ..... N78-29851 #
AES-7804 ..... N78-29852 #
AES-7805 ..... N78-29482 #

AESC-5705-1 ..... N78-29358 #

AFAPL-TR-76-81-VOL-2 ..... N78-29108 #
AFAPL-TR-77-61 ..... N78-29262 #
AFAPL-TR-77-65 ..... N78-29589 #
AFAPL-TR-77-77 ..... N78-29092 #
AFAPL-TR-77-83 ..... N78-29458 #
AFAPL-TR-78-7 ..... N78-29109 #

AFFDL-TR-77-37 ..... N78-29087 #
AFFDL-TR-77-100 ..... N78-29071 #
AFFDL-TR-77-116 ..... N78-29415 #
AFFDL-TR-77-117 ..... N78-29414 #
AFFDL-TR-77-125 ..... N78-29095 #
AFFDL-TR-77-141 ..... N78-29372 #

AFGL-AFSG-377 ..... N78-29136 #

AFGL-TR-77-0260 ..... N78-29136 #
AFGL-TR-78-0022 ..... N78-29678 #
AFGL-TR-78-0026 ..... N78-29680 #
AFGL-TR-78-0045 ..... N78-29366 #
AFGL-TR-78-0091 ..... N78-30030 #
AFGL-TR-0061 ..... N78-29128 #

AFHRL-TR-78-6 (1) ..... N78-29757 #
AFHRL-TR-78-6 (2) ..... N78-29756 #

AFIT/GA/EE/77-6 ..... N78-29090 #
AFIT/GE/EE/77-11 ..... N78-29097 #
AFIT/GE/EE/77-28 ..... N78-29316 #

AFL-78-2-40 ..... N78-29413 #

AFML-TR-77-36 ..... N78-29221 #
AFML-TR-77-125 ..... N78-29253 #
AFML-TR-77-135 ..... N78-29252 #
AFML-TR-77-163 ..... N78-29509 #

AFML-TR-77-171 ..... N78-29457 #
AFML-TR-77-196 ..... N78-29153 #
AFML-TR-77-199 ..... N78-29152 #

AFOSR-78-0210TR ..... N78-29789 #
AFOSR-78-0211TR ..... N78-29755 #
AFOSR-78-0625TR ..... N78-29758 #
AFOSR-78-0696TR ..... N78-29107 #
AFOSR-78-0698TR ..... N78-29251 #
AFOSR-78-0727TR ..... N78-29823 #
AFOSR-78-0728TR ..... N78-29362 #
AFOSR-78-0730TR ..... N78-29811 #
AFOSR-78-0731TR ..... N78-29220 #
AFOSR-78-0734TR ..... N78-29821 #
AFOSR-78-0735TR ..... N78-29315 #
AFOSR-78-0736TR ..... N78-29184 #
AFOSR-78-0737TR ..... N78-29795 #
AFOSR-78-0746TR ..... N78-29892 #
AFOSR-78-0749TR ..... N78-29822 #
AFOSR-78-0757TR ..... N78-29150 #
AFOSR-78-0758TR ..... N78-29069 #
AFOSR-78-0762TR ..... N78-29702 #
AFOSR-78-0767TR ..... N78-29826 #
AFOSR-78-0777TR ..... N78-29317 #
AFOSR-78-0786TR ..... N78-29800 #
AFOSR-78-0855TR ..... N78-29412 #
AFOSR-78-0856TR ..... N78-29110*#
AFOSR-78-0869TR ..... N78-29812 #
AFOSR-78-0878TR ..... N78-29188 #
AFOSR-78-0893TR ..... N78-29370 #
AFOSR-78-0943TR ..... N78-29248 #
AFOSR-78-076023TR ..... N78-29413 #

AFWL-TR-77-134 ..... N78-29681 #

AI-M-426 ..... N78-29810 #

ALO-33 ..... N78-29600 #

AMMRC-TR-78-5 ..... N78-29455 #
AMMRC-TR-78-6 ..... N78-29456 #
AMMRC-TR-78-7 ..... N78-29959 #

AMRL-TR-73-110-VOL-1 ..... N78-29872 #
AMRL-TR-73-110-VOL-4 ..... N78-29873 #

ANL-CT-78-11 ..... N78-29510 #

ANL-TRANS-1115-PT-1 ..... N78-29632 #
ANL-TRANS-1117-PT-3 ..... N78-29633 #

APL/BCE-T-0674 ..... N78-29466 #

AR-2 ..... N78-29154 #
AR-3 ..... N78-29727 #
AR-000-120 ..... N78-29495
AR-000-860 ..... N78-29403

ARBRL-MR-02814 ..... N78-29427 #
ARBRL-MR-02816 ..... N78-29249 #

ARBRL-TR-02050 ..... N78-29684 #
ARBRL-TR-02051 ..... N78-29682 #

ARC-TM-1064 ..... N78-29145*#

ARL/MAT-NOTE-120 ..... N78-29495
ARL/MECH-ENG-REPT-150 ..... N78-29403
ARL/MECH-ENG-TM-387 ..... N78-29453 #
ARL/PSU-TM-77-274 ..... N78-29222 #

ARO-14027.1-CX ..... N78-29439 #
ARO-15322.1-A-EL ..... N78-29359 #

ASME/GPT-1978/1 ..... N78-29288 #

AVRADCOM-TR-78-15(AM) ..... N78-29068*#
AVRADCOM-TR-78-17(AM) ..... N78-29044*#
AVRADCOM-TR-78-32(AM) ..... N78-29067*#
AVRADCOM-TR-78-39(PL) ..... N78-29215*#

BATT-G-6306 ..... N78-29454 #

BBN-3803 ..... N78-29796 #

BLL-CE-TRANS-7083-(9022.09) ..... N78-29066 #

BLL-PO-TRANS-3502-(7737.47) ..... N78-29242 #
BLL-PO-TRANS-3516-(7737.47) N78-29298
BLL-PO-TRANS-3531-(7737.47) ..... N78-29422 #
BLL-PO-TRANS-3538-(7737.47) N78-29341
BLL-PO-TRANS-3541-(7737.47) N78-29299
BLL-PO-TRANS-3553-(7737.47) ..... N78-29340 #
BLL-PO-TRANS-3555-(7737.47) ..... N78-29210 #
BLL-PO-TRANS-3557-(7737.47) ..... N78-29469 #
BLL-PO-TRANS-3558-(7737.47) ..... N78-29180 #
BLL-PO-TRANS-3564-(7737.47) ..... N78-29243 #

BLL-RTS-10557 ..... N78-29337
BLL-RTS-10585 ..... N78-29402
BLL-RTS-10633 ..... N78-29338
BLL-RTS-10955 ..... N78-29339
BLL-RTS-10973 ..... N78-29209

BLL-TRANS-1309 ..... N78-29717

BLLD-M-24959-(5828.4F) N78-29717
BLLD-M-25563-(5828.4F) N78-29401

BM-RI-8271 ..... N78-29966 #
BM-RI-8272 ..... N78-29198 #
BM-RI-8277 ..... N78-29197 #

BMFT-FB-T-77-43 ..... N78-29581 #
BMFT-FB-T-77-44 ..... N78-29736 #
BMFT-FB-T-77-48 ..... N78-29569 #
BMFT-FB-T-77-64 ..... N78-29582 #

BNL-23648 ..... N78-29896 #
BNL-23650 ..... N78-29895 #
BNL-23651 ..... N78-29897 #
BNL-23829 ..... N78-29635 #
BNL-50723 ..... N78-29594 #
BNL-50731 ..... N78-29898 #
BNL-50751 ..... N78-29611 #

BRL-IMR-510 ..... N78-29682 #

BR63467 ..... N78-29452 #
BR63504 ..... N78-29354 #
BR63522 ..... N78-29311 #
BR63693 ..... N78-29218 #

CAL-1405 ..... N78-29539*#

CALSPAN-AB-5487-A-3 ..... N78-29412 #

CASD-NAS-78-007 ..... N78-29142*#

CDC-EMO-78-01 ..... N78-29970 #

CED-78-66 ..... N78-29556 #
CED-78-79 ..... N78-29746 #

CEEDO-TR-78-14 ..... N78-29261 #

CEL-CR-78.006 ..... N78-29277 #

CEL-TM-1517 ..... N78-29588 #
CEL-TM-1519 ..... N78-29375 #

CEL-TR-863 ..... N78-29247 #
CEL-TR-865 ..... N78-29113 #

CFHR-3-5-74-29-2F ..... N78-29278 #

CM-8 ..... N78-29705 #

COM-73-11580 ..... N78-29978 #
COM-73-11707 ..... N78-30000 #
COM-73-11717 ..... N78-29977 #
COM-74-10935 ..... N78-29270 #
COM-74-10969 ..... N78-29551 #

CONF-770367 ..... N78-29610 #
CONF-770664-ABSTS ..... N78-29614 #
CONF-770756 ..... N78-29591 #
CONF-770849-4 ..... N78-29925 #
CONF-770854-1 ..... N78-29637 #
CONF-770937-2 ..... N78-29778 #
CONF-770940-19 ..... N78-29897 #
CONF-770940-20 ..... N78-29895 #
CONF-770940-24 ..... N78-29896 #
CONF-771040-4 ..... N78-29429 #
CONF-771136-23 ..... N78-29442 #
CONF-780113-2 ..... N78-29923 #
CONF-780113-5 ..... N78-29922 #
CONF-780113-6 ..... N78-29920 #

CONF-780113-7 ..... N78-29928 #
CONF-780121-1 ..... N78-29635 #
CONF-780122-1 ..... N78-29607 #
CONF-780217-1 ..... N78-29192 #
CONF-780219-1 ..... N78-29777 #
CONF-780303-2 ..... N78-29998 #
CONF-780305-4 ..... N78-29255 #
CONF-780318-ABSTS ..... N78-29927 #
CONF-780406-3 ..... N78-29156 #
CONF-780410-1 ..... N78-29546 #
CONF-780502-4 ..... N78-29605 #
CONF-780502-5 ..... N78-29606 #
CONF-7610144-1 ..... N78-29227 #

CONS/0108-1 ..... N78-29574*#
CONS/9427-2 ..... N78-29449*#

COO-2570-3 ..... N78-29151 #
COO-2733-15 ..... N78-29511 #
COO-2865-11 ..... N78-29598 #
COO-4264-1 ..... N78-29805 #

CRA-322 ..... N78-29465 #

CRIF-MT-119 ..... N78-29519 #
CRIF-MT-122 ..... N78-29520 #

CRINC-FRL-281-3 ..... N78-29086*#

CRREL-TRANS-676 ..... N78-29728 #

CRREL-78-2 ..... N78-29679 #
CRREL-78-7 ..... N78-29686 #

CRWR-156 ..... N78-29557 #

CSCPRC-3 ..... N78-29840 #

CSIR-TRANS-1401 ..... N78-29425 #
CSIR-TRANS-1402 ..... N78-29305 #

CTH-MATH-1977-12 ..... N78-29864 #
CTH-MATH-1977-15 ..... N78-29865 #

DELET-TR-78-2 ..... N78-29369 #

DGLR-76-138 ..... N78-29425 #

DLR-IB-151-77/13 ..... N78-29072 #
DLR-IB-151-77/19 ..... N78-29075 #
DLR-IB-257-77/2 ..... N78-29878 #
DLR-IB-257-77/14 ..... N78-29877 #
DLR-IB-453-78/1 ..... N78-29196 #
DLR-IB-552-77/22 ..... N78-29779 #
DLR-IB-552-77/23 ..... N78-29130 #
DLR-IB-552-78/1 ..... N78-29548 #

DNA-4187F-1 ..... N78-29223 #
DNA-4412T ..... N78-29324 #
DNA-4443F ..... N78-29685 #
DNA-4445F ..... N78-29683 #
DNA-4452T ..... N78-29321 #

DOC-R77AEG400-VOL-1 ..... N78-29099*#

DOE-TR-77 ..... N78-29380 #

DOE/ET-0034 ..... N78-29593*#
DOE/EV-0008/2 ..... N78-29636 #
DOE/NASA/0592-78/1 ..... N78-29584*#
DOE/NASA/0595-78/1 ..... N78-29992*#
DOE/NASA/1011-78/24 ..... N78-29994*#
DOE/NASA/1022-78/30 ..... N78-29566*#
DOE/NASA/1022-78/41 ..... N78-29578*#
DOE/NASA/1034-78/1 ..... N78-29577*#
DOE/NASA/1034-78/2 ..... N78-29576*#
DOE/NASA/1059-78/1 ..... N78-29575*#
DOE/NASA/2593-78/1 ..... N78-29216*#
DOE/NASA/7405-78/1 ..... N78-29408*#
DOE/NASA/7405-78/2 ..... N78-29409*#

DOT-HS-803-262 ..... N78-29468 #

DOT-TSC-RSPD-77-2 ..... N78-29079 #
DOT-TSC-RSPD-78-4 ..... N78-29465 #

DOT-TSC-UMTA-78-2 ..... N78-30006 #

DRDMI-T-78-39 ..... N78-29322 #

DREV-R-4105/78 ..... N78-29437 #

DSE/2457-4 ..... N78-29595 #
DSE/2457-5 ..... N78-29759 #

DTNSRDC-78/041 ..... N78-29726 #

D180-24071-1-PT-3 ..... N78-29133*#
D210-11278-1 ..... N78-29083*#

E-8916-2 ..... N78-29100*#
E-9553 ..... N78-29575*#
E-9609 ..... N78-29566*#
E-9613 ..... N78-29994*#
E-9674 ..... N78-29246*#
E-9689 ..... N78-29216*#
E-9698 ..... N78-29577*#
E-9702 ..... N78-29576*#
E-9716 ..... N78-29407*#
E-9726 ..... N78-29215*#

ECCTS/TR-78/02 ..... N78-29798 #

ECD-866-19292-R ..... N78-29109 #

ECOM-DR-942 ..... N78-29704 #

ECOM-73-0304-F ..... N78-29312 #
ECOM-77-0189-1-A ..... N78-29327 #

EG/G-TR-4618-0001 ..... N78-29428 #

EMD-78-53 ..... N78-29624 #

EOARD-TR-78-2 ..... N78-29827 #

EPA-430/9-77-005 ..... N78-30004 #
EPA-430/9-77-012 ..... N78-30005 #
EPA-430/9-78-001 ..... N78-30003 #
EPA-430/9-78-002 ..... N78-30002 #
EPA-440/9-76-024 ..... N78-29647 #
EPA-550/9-78-101 ..... N78-29650 #
EPA-600/2-77-017D ..... N78-30008 #
EPA-600/2-77-155B ..... N78-29655 #
EPA-600/2-77-223 ..... N78-29654 #
EPA-600/2-78-003 ..... N78-29553 #
EPA-600/2-78-032 ..... N78-29656 #
EPA-600/2-78-091 ..... N78-29286 #
EPA-600/3-78-025 ..... N78-29733 #
EPA-600/3-78-048B ..... N78-29658 #
EPA-600/4-78-020 ..... N78-29649 #
EPA-600/7-77-143 ..... N78-29272 #
EPA-600/7-78-037 ..... N78-29644 #
EPA-600/7-78-045A-VOL-1 ..... N78-29638 #
EPA-600/7-78-045B-VOL-2 ..... N78-29639 #
EPA-600/7-78-056 ..... N78-29648 #
EPA-600/7-78-061 ..... N78-29275 #
EPA-600/8-78-003 ..... N78-29971 #
EPA-910/9-78-048 ..... N78-29646 #

EPRI-AF-687 ..... N78-29263 #

EPRI-EA-586 ..... N78-29599 #
EPRI-EA-703-VOL-2 ..... N78-29602 #

EPRI-EL-605 ..... N78-29381 #

EPRI-EM-570 ..... N78-29596 #

EPRI-ER-591 ..... N78-29444 #
EPRI-ER-635-VOL-1 ..... N78-29612 #

ERSD-110-77-3 ..... N78-29526 #

ESA-TT-478 ..... N78-29524 #

ESD-TR-78-24 ..... N78-29374 #
ESD-TR-78-25 ..... N78-29326 #
ESD-TR-78-28 ..... N78-29907 #
ESD-TR-78-30 ..... N78-29328 #

ESDU-78008 ..... N78-29660

ESL-P-809 ..... N78-29318 #

ESL-3815-5 ..... N78-29315 #
ESL-4299-4 ..... N78-29307*#
ESL-4299-5 ..... N78-29134*#

ESL-784299-6 ..... N78-29668*#

ETL-0142 ..... N78-29545 #

E78-10174 ..... N78-29531*#
E78-10176 ..... N78-29532*#
E78-10177 ..... N78-29533*#
E78-10178 ..... N78-29534*#

FAA-AAP-78-2(1) ..... N78-29628 #
FAA-AAP-78-2(2) ..... N78-29629 #

FAA-AM-78-17 ..... N78-29078 #

FAA-RD-77-189,2-VOL-2 ..... N78-29084 #
FAA-RD-77-189,3-VOL-3 ..... N78-29085 #
FAA-RD-78-7 ..... N78-29699*#

FB-91 ..... N78-29497 #

FCT-492 ..... N78-29529 #

FE-2556-13 ..... N78-29416 #
FE-2556-14 ..... N78-29417 #

FFA-TN-HU-1755 ..... N78-29462 #
FFA-TN-HU-1848 ..... N78-29522 #
FFA-TN-HU-1911 ..... N78-29523 #

FGMSD-78-22 ..... N78-29783 #

FHWA-NY-78-RR-59 ..... N78-29292 #

FHWA-RD-77-102 ..... N78-29657 #
FHWA-RD-78-S0701 ..... N78-29526 #

FHWA/CA/TL-3489-77-13 ..... N78-29291 #
FHWA/CT/RD-360-S-78-4 ..... N78-29782 #
FHWA/LA-112 ..... N78-29464 #
FHWA/RD-78-S0696 ..... N78-29278 #
FHWA/TS-77/216 ..... N78-29293 #
FHWA/VHTRC-78-R27 ..... N78-29285 #
FHWA/WV-77/6-VOL-1 ..... N78-29282 #
FHWA/WV-77/6-VOL-2 ..... N78-29283 #

FIS-76-4039A ..... N78-29308*#
FIS-77-4057-VOL-3 ..... N78-29306*#

FLOW-RR-83 ..... N78-29071 #

FOA-A-59002-H3 ..... N78-29761 #

FOA-B-20009-D4(F3) ..... N78-29228 #
FOA-B-20015-T1 ..... N78-29690 #
FOA-B-20016-D4 ..... N78-29463 #
FOA-B-30021-E1 ..... N78-29790 #

FOA-C-20184-D8 ..... N78-29418 #
FOA-C-20187-E4 ..... N78-29813 #
FOA-C-20201-H2 ..... N78-29258 #
FOA-C-20204-D4(A3) ..... N78-29516 #
FOA-C-20205-D8(H4) ..... N78-29986 #
FOA-C-20213-D3 ..... N78-29264 #
FOA-C-20216-D1 ..... N78-29265 #
FOA-C-20221-E4 ..... N78-29383 #
FOA-C-40069-A3 ..... N78-29731 #
FOA-C-40070-A3 ..... N78-29732 #
FOA-C-40072-H2 ..... N78-29744 #
FOA-C-54018-H2/H6 ..... N78-29730 #
FOA-C-56010-H9/H6 ..... N78-29751 #

FR-1 ..... N78-29438 #
FR-77-16-995 ..... N78-29365 #
FR-82 ..... N78-29554 #

FRA/ORD-78/06 ..... N78-29525 #
FRA/ORD-78/07 ..... N78-29467 #

FWS/OBS-77/36 ..... N78-29562 #

GA-A-14614-VOL-11 ..... N78-29919 #
GA-A-14783 ..... N78-29923 #
GA-A-14808 ..... N78-29922 #
GA-A-14809 ..... N78-29921 #
GA-A-14810 ..... N78-29920 #

GGD-78-51 ..... N78-29984 #

GWU-SCD-78/1 ..... N78-29982 #

H-981 ..... N78-29843*#

HAC-REF-D2444 ..... N78-29304*#

HCP/M4007-01 ..... N78-29592 #

HDL-TM-77-38 ..... N78-29740 #

HONEYWELL-46585 ..... N78-29371 #

HRI-391 ..... N78-29276*#

HSER-7342 ..... N78-29974 #

H400-12-1-053 ..... N78-29153 #

ICAF-1012 ..... N78-29499 #
ICAF-1013 ..... N78-29497 #
ICAF-1036 ..... N78-29504 #
ICAF-1039 ..... N78-29501 #

IIHR-211 ..... N78-29563 #

IITRI-E-6357-12 ..... N78-29363 #

IMMR32-M4-77 ..... N78-29559 #
IMMR33-PD20-78 ..... N78-29273 #

IMS-DATA-PUB-4 ..... N78-29696 #

INCO/1088-1277-TR-55-D(F) ..... N78-29773 #

INPE-1005-TPT/049 ..... N78-29542 #
INPE-1032-PE/057 ..... N78-29677 #
INPE-1037-NTE/089 ..... N78-29700 #
INPE-1040-RAE/027 ..... N78-29135 #
INPE-1055-PE/062 ..... N78-29792 #
INPE-1065-PE/064 ..... N78-29670 #
INPE-1074-NTE/100 ..... N78-29540 #
INPE-1077-NTE/103 ..... N78-29543 #
INPE-1081-PE/067 ..... N78-29667 #
INPE-1108-PE/082 ..... N78-29671 #
INPE-1144-PE/098 ..... N78-29676 #
INPE-1196-PE/112 ..... N78-29917 #
INPE-1210-PE/120 ..... N78-29536*#
INPE-1218-PE/122 ..... N78-30035*#
INPE-1227-NTE/115 ..... N78-29541 #
INPE-1260-PE/136 ..... N78-29666 #
INPE-1263-TPT/087 ..... N78-29967 #
INPE-1282-PE/138 ..... N78-29537*#
INPE-1304-TPT/096 ..... N78-29793 #

IPF-77-2 ..... N78-29930 #
IPF-77-5 ..... N78-29445 #
IPF-78-2 ..... N78-29446 #
IPF-78-3 ..... N78-29931 #

IPPJ-333 ..... N78-29912 #
IPPJ-334 ..... N78-29913 #
IPPJ-335 ..... N78-29914 #
IPPJ-336-PT-1 ..... N78-29915 #

IR-2 ..... N78-29603 #

IRT-8163-004 ..... N78-29683 #

ISBN-0-309-02609-1 ..... N78-29840 #
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ISI/TM-78-10 ..... N78-29774 #

ISSN-0568-0581 ..... N78-29665*#

ITT-A/OD-81100-TR-1 ..... N78-29327 #

IWR-CR-77-10 ..... N78-29985 #

KNMI-WR-78-1 ..... N78-29430 #

KTECH-TR-76-11-1 ..... N78-29223 #

L-12178 ..... N78-29046*#

LA-TR-77-68 ..... N78-29279 #

LA-UR-77-174 ..... N78-29443 #
LA-UR-77-2070 ..... N78-29778 #
LA-UR-77-2474 ..... N78-29429 #
LA-UR-78-51 ..... N78-29928 #
LA-UR-78-329 ..... N78-29777 #
LA-UR-78-347 ..... N78-29546 #

LA-69-1G ..... N78-29464 #
LA-6889-MS ..... N78-29547 #
LA-7053-MS-VOL-11 ..... N78-29919 #
LA-7084 ..... N78-29191 #
LA-7098-PR ..... N78-29760 #
LA-7110-MS ..... N78-29514 #
LA-7130 ..... N78-29804 #
LA-7160C ..... N78-29927 #

LBL-6686 ..... N78-29226 #
LBL-6856 ..... N78-29607 #
LBL-6994 ..... N78-29155 #
LBL-7262 ..... N78-29998 #

LC-63-60099 ..... N78-29287 #
LC-77-77290 ..... N78-29694 #
LC-77-79329 ..... N78-29840 #
LC-77-84406 ..... N78-29549 #
LC-77-84406 ..... N78-29550 #
LC-77-86463 ..... N78-29640 #
LC-77-87121 ..... N78-29641 #
LC-78-B1 ..... N78-29481 #
LC-78-EM1 ..... N78-29476 #
LC-78-EM2 ..... N78-29477 #
LC-78-EM3 ..... N78-29478 #
LC-78-EM4 ..... N78-29480 #
LC-78-IC1 ..... N78-29479 #
LC-78-VT1 ..... N78-29474 #
LC-78-1 ..... N78-29475 #
LC-78-2-VOL-1 ..... N78-29470 #
LC-78-2-VOL-3 ..... N78-29471 #
LC-78-2-VOL-4 ..... N78-29472 #
LC-78-2-VOL-5 ..... N78-29473 #
LC-78-606023 ..... N78-29488 #

LCD-77-109 ..... N78-29080 #

LEC-12175 ..... N78-29791*#
LEC-12176 ..... N78-29794*#

LPI-CONTRIB-329 ..... N78-29663*#

LR-28196 ..... N78-29509 #
LR-28307-VOL-2 ..... N78-29084 #
LR-28307-VOL-3 ..... N78-29085 #

MA-RD-920-77085-A ..... N78-29234 #

MA-183T ..... N78-29424*#

MBL-1977-5 ..... N78-29743 #

MCR-78-572 ..... N78-29352*#
MCR-78-578 ..... N78-29146*#

MDC-J7180 ..... N78-29372 #

ME/77/28 ..... N78-29450 #

MERC/RI-77/3 ..... N78-29461 #

MIC-AN-04 ..... N78-29975 #

MRC-R-334 ..... N78-29324 #

MRC-TSR-1818 ..... N78-29190 #
MRC-TSR-1819 ..... N78-29189 #
MRC-TSR-1820 ..... N78-29830 #
MRC-TSR-1821 ..... N78-29846 #
MRC-TSR-1822 ..... N78-29861 #
MRC-TSR-1823 ..... N78-29833 #
MRC-TSR-1824 ..... N78-29832 #
MRC-TSR-1825 ..... N78-29831 #
MRC-TSR-1826 ..... N78-29847 #
MRC-TSR-1828 ..... N78-29862 #
MRC-TSR-1829 ..... N78-29863 #
MRC-TSR-1832 ..... N78-29828 #
MRC-TSR-1833 ..... N78-29835 #
MRC-TSR-1834 ..... N78-29848 #
MRC-TSR-1835 ..... N78-29376 #
MRC-TSR-1836 ..... N78-29834 #
MRC-TSR-1837 ..... N78-29838 #
MRC-TSR-1838 ..... N78-29836 #
MRC-TSR-1839 ..... N78-29837 #

MRR-77-11 ..... N78-29821 #

MTI-76TR41-VOL-2 ..... N78-29108 #

MTP-7-3-021 ..... N78-29091 #
MTP-7-3-518 ..... N78-29091 #
MTP-7-3-520 ..... N78-29091 #

NADC-78055-60 ..... N78-29077 #

NAEC-AWS-571-REV-A ..... N78-29093 #

NAEC-ENG-7945 ..... N78-29112 #

NASA-CASE-GSC-12348-1 ..... N78-29902*#

NASA-CASE-LAR-12172-1 ..... N78-29310*#
NASA-CASE-LAR-12176-1 ..... N78-29435*#
NASA-CASE-LAR-12304-1 ..... N78-29871*#

NASA-CASE-NPO-11954-1 ..... N78-29421*

NASA-CP-2036-PT-2 ..... N78-29046*#
NASA-CP-2056 ..... N78-29669*#

NASA-CR-134992 ..... N78-29353*#
NASA-CR-135079 ..... N78-29916*#
NASA-CR-135173 ..... N78-29350*#
NASA-CR-135174 ..... N78-29351*#
NASA-CR-135189-VOL-1 ..... N78-29867*#
NASA-CR-135189-VOL-2 ..... N78-29868*#
NASA-CR-135189-VOL-3 ..... N78-29869*#
NASA-CR-135316 ..... N78-29574*#
NASA-CR-135340 ..... N78-29584*#
NASA-CR-135341 ..... N78-29992*#
NASA-CR-135345 ..... N78-29408*#
NASA-CR-135346 ..... N78-29409*#
NASA-CR-135391 ..... N78-29099*#
NASA-CR-135402 ..... N78-29449*#
NASA-CR-135406 ..... N78-29187*#
NASA-CR-135407 ..... N78-29105*#
NASA-CR-135417 ..... N78-29104*#
NASA-CR-135432 ..... N78-29217*#
NASA-CR-135435 ..... N78-29276*#
NASA-CR-141441 ..... N78-29127*#
NASA-CR-144875 ..... N78-29101*#
NASA-CR-144876 ..... N78-29102*#
NASA-CR-145348-VOL-1 ..... N78-29119*#
NASA-CR-145348-VOL-2 ..... N78-29120*#
NASA-CR-145348-VOL-3 ..... N78-29121*#
NASA-CR-145348-VOL-4 ..... N78-29122*#
NASA-CR-145377 ..... N78-29083*#
NASA-CR-145379 ..... N78-29082*#
NASA-CR-150740 ..... N78-29570*#
NASA-CR-150743 ..... N78-29571*#
NASA-CR-150744 ..... N78-29579*#
NASA-CR-150747 ..... N78-29580*#
NASA-CR-150761 ..... N78-29352*#
NASA-CR-150764 ..... N78-29116*#
NASA-CR-150765 ..... N78-29123*#
NASA-CR-150766 ..... N78-29182*#
NASA-CR-150768 ..... N78-29183*#
NASA-CR-151746 ..... N78-29133*#
NASA-CR-151750 ..... N78-29567*#
NASA-CR-151751 ..... N78-29140*
NASA-CR-151752 ..... N78-29302*#
NASA-CR-151753 ..... N78-29424*#
NASA-CR-151755 ..... N78-29145*#
NASA-CR-151807 ..... N78-29142*#
NASA-CR-151808 ..... N78-29143*#
NASA-CR-151810 ..... N78-29791*#
NASA-CR-151811 ..... N78-29794*#
NASA-CR-151812 ..... N78-29754*#
NASA-CR-151814 ..... N78-29141*#
NASA-CR-151815 ..... N78-29144*#

NASA-CR-151816 ..... N78-29724*#
NASA-CR-151818 ..... N78-29993*#
NASA-CR-151819 ..... N78-29723*#
NASA-CR-152153-1 ..... N78-29995*#
NASA-CR-152153-2 ..... N78-29996*#
NASA-CR-152171 ..... N78-29146*#
NASA-CR-156776 ..... N78-29304*#
NASA-CR-156781 ..... N78-29309*#
NASA-CR-156784 ..... N78-29308*#
NASA-CR-156785 ..... N78-29307*#
NASA-CR-156793 ..... N78-30026*#
NASA-CR-156795 ..... N78-29134*#
NASA-CR-156796 ..... N78-29668*#
NASA-CR-156801 ..... N78-29306*#
NASA-CR-156943 ..... N78-29665*#
NASA-CR-156944 ..... N78-29979*#
NASA-CR-156945 ..... N78-29110*#
NASA-CR-156948 ..... N78-29674*#
NASA-CR-157217 ..... N78-29697*#
NASA-CR-157269 ..... N78-29531*#
NASA-CR-157271 ..... N78-29532*#
NASA-CR-157272 ..... N78-29533*#
NASA-CR-157354 ..... N78-29673*#
NASA-CR-157355 ..... N78-29086*#
NASA-CR-157356 ..... N78-29539*#
NASA-CR-157358 ..... N78-29503*#
NASA-CR-157359 ..... N78-30022*#
NASA-CR-157361 ..... N78-30028*#
NASA-CR-157362 ..... N78-29117*#
NASA-CR-157363 ..... N78-29118*#
NASA-CR-157368 ..... N78-29820*#
NASA-CR-157369 ..... N78-29585*#
NASA-CR-157391 ..... N78-29537*#
NASA-CR-157393 ..... N78-29536*#
NASA-CR-157465 ..... N78-29131*#
NASA-CR-157466 ..... N78-29132*#
NASA-CR-157467 ..... N78-29911*#
NASA-CR-157468 ..... N78-29663*#
NASA-CR-157469 ..... N78-29076*#
NASA-CR-157470 ..... N78-29699*#
NASA-CR-157472 ..... N78-29303*#
NASA-CR-157473 ..... N78-29664*#
NASA-CR-157474 ..... N78-29349*#
NASA-CR-157475 ..... N78-29568*#
NASA-CR-157571 ..... N78-29870*#
NASA-CR-158898 ..... N78-29426*#
NASA-CR-159390 ..... N78-29103*#
NASA-CR-159413 ..... N78-29410*#
NASA-CR-159890 ..... N78-29045*#

NASA-NEWS-RELEASE-78-129 ..... N78-29115*

NASA-SP-222(03) ..... N78-29506*#
NASA-SP-223(03) ..... N78-29505*#
NASA-SP-423 ..... N78-30025*

NASA-TM-56045 ..... N78-29843*#
NASA-TM-58185 ..... N78-29725*#
NASA-TM-73193 ..... N78-29436*#
NASA-TM-73507-VOL-1 ..... N78-29100*#
NASA-TM-73767 ..... N78-29575*#
NASA-TM-75055 ..... N78-29535*#
NASA-TM-78019 ..... N78-29544*#
NASA-TM-78099 ..... N78-30036*#
NASA-TM-78179 ..... N78-29572*#
NASA-TM-78181 ..... N78-29698*#
NASA-TM-78182 ..... N78-29573*#
NASA-TM-78331 ..... N78-30035*#
NASA-TM-78479 ..... N78-29067*#
NASA-TM-78489 ..... N78-29044*#
NASA-TM-78492 ..... N78-29068*#
NASA-TM-78501 ..... N78-29451*#
NASA-TM-78509 ..... N78-29149*#
NASA-TM-78880 ..... N78-29566*#
NASA-TM-78884 ..... N78-29994*#
NASA-TM-78890 ..... N78-29214*#
NASA-TM-78931 ..... N78-29246*#
NASA-TM-78942 ..... N78-29216*#
NASA-TM-78950 ..... N78-29245*#
NASA-TM-78952 ..... N78-29577*#
NASA-TM-78953 ..... N78-29576*#
NASA-TM-78964 ..... N78-29578*#
NASA-TM-78967 ..... N78-29215*#
NASA-TM-78969 ..... N78-29407*#
NASA-TM-79400 ..... N78-29593*#
NASA-TM-79545 ..... N78-29534*#
NASA-TM-79595 ..... N78-29672*#
NASA-TM-79599 ..... N78-30023*#
NASA-TM-79600 ..... N78-30037*#
NASA-TM-79604 ..... N78-30027*#
NASA-TM-79605 ..... N78-30018*#
NASA-TM-79740 ..... N78-29538*#
NASA-TM-79757 ..... N78-29583*#

NBS-GCR-78-123 ..... N78-29289 #

NBS-SP-250-1970 ..... N78-29287 #
NBS-SP-250-1978 ..... N78-29287 #
NBS-SP-400-36 ..... N78-29488 #
NBS-SP-500-29 ..... N78-29290 #

NBS-TN-1003 ..... N78-29334 #

NBSIR-78-874 ..... N78-29866 #
NBSIR-78-876 ..... N78-29335 #
NBSIR-78-1446 ..... N78-29784 #

NEAR-TR-152 ..... N78-29070 #

NEPP-1-A-VOL-2 ..... N78-29620 #
NEPP-8 ..... N78-29621 #

NHK-LABS-NOTE-219 ..... N78-29748
NHK-LABS-NOTE-220 ..... N78-29954
NHK-LABS-NOTE-221 ..... N78-29423
NHK-LABS-NOTE-222 ..... N78-29342
NHK-LABS-NOTE-223 ..... N78-29300

NLR-MP-76001-U ..... N78-29762 #
NLR-MP-76015-U ..... N78-29763 #
NLR-MP-77004-U ..... N78-29518 #
NLR-MP-77011-U ..... N78-29096 #
NLR-MP-77014-U ..... N78-29853 #
NLR-MP-77018-U ..... N78-29483 #
NLR-MP-77025-U ..... N78-29073 #
NLR-MP-77037-U ..... N78-29138 #

NLR-TR-77001-U ..... N78-29420 #
NLR-TR-77070-U ..... N78-29331 #
NLR-TR-77090-U ..... N78-29074 #

NMRC-KP-164 ..... N78-29274 #

NOAA-DR-ERL-WPL-1 ..... N78-29695 #

NOAA-TM-EDS-23 ..... N78-29710 #
NOAA-TM-EDS-24 ..... N78-29709 #

NOAA-TM-ERL-AOML-29 ..... N78-29721 #
NOAA-TM-ERL-AOML-30 ..... N78-29622 #

NOAA-TM-ERL-NSSL-83 ..... N78-29714 #

NOAA-TM-NWS-HYDRO-37 ..... N78-29560 #

NOAA-TM-NWS-SR-94 ..... N78-29708 #
NOAA-TM-NWS-SR-95 ..... N78-29711 #

NOAA-TR-NMFS-SSRF-719 ..... N78-29720 #

NOAA-78022801 ..... N78-29708 #
NOAA-78031302 ..... N78-29722 #
NOAA-78032401 ..... N78-29720 #
NOAA-78032403 ..... N78-29711 #
NOAA-78032404 ..... N78-30031 #
NOAA-78032405 ..... N78-30032 #
NOAA-78032406 ..... N78-30033 #
NOAA-78032801 ..... N78-29696 #
NOAA-78040601 ..... N78-29560 #
NOAA-78040602 ..... N78-29695 #
NOAA-78040603 ..... N78-29712 #
NOAA-78041210 ..... N78-29983 #
NOAA-78041213 ..... N78-29139 #
NOAA-78041214 ..... N78-29710 #
NOAA-78041215 ..... N78-29709 #
NOAA-78041216 ..... N78-29622 #
NOAA-78041217 ..... N78-29721 #
NOAA-78041224 ..... N78-29714 #

NOR-77-115 ..... N78-29457 #

NOSC-TR-208 ..... N78-29323 #

NP-22877 ..... N78-29601 #

NPL-CHEM-79 ..... N78-29193 #
NPL-CHEM-80 ..... N78-29194 #
NPL-CHEM-81 ..... N78-29195 #

NPL-MOM-24 ..... N78-29281 #
NPL-MOM-27 ..... N78-29517 #

NPL-NAC-87 ..... N78-29839 #

NPL-QU-43 ..... N78-29447 #

NPS-63CJ78031 ..... N78-29706 #

NRC/TELECOM-78/3 ..... N78-29336 #

NRL-MR-3721 ..... N78-29154 #
NRL-MR-3724 ..... N78-29893 #
NRL-MR-3725 ..... N78-29905 #
NRL-MR-3744 ..... N78-29918 #
NRL-MR-3764 ..... N78-29631 #

NRL-8176 ..... N78-29775 #
NRL-8180 ..... N78-29874 #
NRL-8186 ..... N78-29875 #

NSF-77-78 ..... N78-29972 #

NSF/IDOE-78-32 ..... N78-29718 #
NSF/IDOE-78-33 ..... N78-29719 #
NSF/PRA-7519704/2/7-PT-2 ..... N78-30010 #
NSF/RA-770254 ..... N78-29549 #
NSF/RA-770255 ..... N78-29550 #
NSF/RA-770439 ..... N78-29973 #
NSF/RA-770440 ..... N78-30001 #
NSF/RA-770441 ..... N78-29972 #
NSF/RA-780003 ..... N78-29988 #
NSF/RA-780030 ..... N78-30011 #

NSWC/WOL/TR-77-67-1 ..... N78-29587 #
NSWC/WOL/TR-77-183 ..... N78-29845 #
NSWC/WOL/TR-78-5 ..... N78-29361 #
NSWC/WOL/TR-78-29 ..... N78-29224 #

NTIS/PS-ML/0280 ..... N78-29999 #
NTIS/PS-75/154 ..... N78-29392 #
NTIS/PS-75/165 ..... N78-29333 #
NTIS/PS-75/175 ..... N78-29879 #
NTIS/PS-75/209 ..... N78-29643 #
NTIS/PS-75/210 ..... N78-29651 #
NTIS/PS-75/227 ..... N78-29388 #
NTIS/PS-75/244 ..... N78-29881 #
NTIS/PS-75/289 ..... N78-29235 #
NTIS/PS-75/325 ..... N78-29384 #
NTIS/PS-75/338 ..... N78-29386 #
NTIS/PS-75/357 ..... N78-30000 #
NTIS/PS-75/362 ..... N78-29551 #
NTIS/PS-75/378 ..... N78-29978 #
NTIS/PS-75/381 ..... N78-29270 #
NTIS/PS-75/384 ..... N78-29745 #
NTIS/PS-75/411 ..... N78-29977 #
NTIS/PS-75/655 ..... N78-29266 #
NTIS/PS-76/0221 ..... N78-29487 #
NTIS/PS-76/0271 ..... N78-29388 #
NTIS/PS-76/0279 ..... N78-30000 #
NTIS/PS-76/0287 ..... N78-29753 #
NTIS/PS-76/0308 ..... N78-29386 #
NTIS/PS-76/0309 ..... N78-29387 #
NTIS/PS-76/0312 ..... N78-29384 #
NTIS/PS-76/0313 ..... N78-29385 #
NTIS/PS-76/0315 ..... N78-29643 #
NTIS/PS-76/0319 ..... N78-29551 #
NTIS/PS-76/0320 ..... N78-29552 #
NTIS/PS-76/0330 ..... N78-29333 #
NTIS/PS-76/0343 ..... N78-29651 #
NTIS/PS-76/0344 ..... N78-29879 #
NTIS/PS-76/0346 ..... N78-29880 #
NTIS/PS-76/0360 ..... N78-29392 #
NTIS/PS-76/0361 ..... N78-29390 #
NTIS/PS-76/0379 ..... N78-29978 #
NTIS/PS-76/0387 ..... N78-29745 #
NTIS/PS-76/0399 ..... N78-29270 #
NTIS/PS-76/0407 ..... N78-29268 #
NTIS/PS-76/0415 ..... N78-29235 #
NTIS/PS-76/0417 ..... N78-29881 #
NTIS/PS-76/0434 ..... N78-29977 #
NTIS/PS-76/0485 ..... N78-29269 #
NTIS/PS-76/0795 ..... N78-29266 #
NTIS/PS-77/0112 ..... N78-29266 #
NTIS/PS-77/0113 ..... N78-29267 #
NTIS/PS-77/0255 ..... N78-29388 #
NTIS/PS-77/0257 ..... N78-29389 #
NTIS/PS-77/0293 ..... N78-29232 #
NTIS/PS-77/0294 ..... N78-29233 #
NTIS/PS-77/0299 ..... N78-29384 #
NTIS/PS-77/0300 ..... N78-29385 #
NTIS/PS-77/0306 ..... N78-29333 #
NTIS/PS-77/0309 ..... N78-29386 #
NTIS/PS-77/0310 ..... N78-29387 #
NTIS/PS-77/0335 ..... N78-29753 #
NTIS/PS-77/0385 ..... N78-29551 #
NTIS/PS-77/0387 ..... N78-29552 #
NTIS/PS-77/0396 ..... N78-29618 #
NTIS/PS-77/0397 ..... N78-30000 #
NTIS/PS-77/0414 ..... N78-29978 #
NTIS/PS-77/0415 ..... N78-29651 #
NTIS/PS-77/0418 ..... N78-29235 #
NTIS/PS-77/0428 ..... N78-29643 #
NTIS/PS-77/0434 ..... N78-29270 #
NTIS/PS-77/0441 ..... N78-29114 #
NTIS/PS-77/0445 ..... N78-29487 #
NTIS/PS-77/0450 ..... N78-29881 #
NTIS/PS-77/0452 ..... N78-29879 #
NTIS/PS-77/0453 ..... N78-29880 #
NTIS/PS-77/0455 ..... N78-29745 #
NTIS/PS-77/0477 ..... N78-29268 #
NTIS/PS-77/0478 ..... N78-29269 #
NTIS/PS-77/0480 ..... N78-29392 #
NTIS/PS-77/0481 ..... N78-29390 #
NTIS/PS-77/0484 ..... N78-29977 #
NTIS/PS-78/0331/5 ..... N78-29386 #
NTIS/PS-78/0332/3 ..... N78-29387 #
NTIS/PS-78/0333/1 ..... N78-29384 #
NTIS/PS-78/0334/9 ..... N78-29385 #
NTIS/PS-78/0336/4 ..... N78-29332 #
NTIS/PS-78/0337/2 ..... N78-29333 #
NTIS/PS-78/0358/8 ..... N78-29484 #
NTIS/PS-78/0359/6 ..... N78-29485 #
NTIS/PS-78/0361/2 ..... N78-29388 #
NTIS/PS-78/0362/0 ..... N78-29389 #
NTIS/PS-78/0378/6 ..... N78-29752 #
NTIS/PS-78/0379/4 ..... N78-29753 #
NTIS/PS-78/0407/3 ..... N78-29271 #
NTIS/PS-78/0423/0 ..... N78-29551 #
NTIS/PS-78/0424/8 ..... N78-29552 #
NTIS/PS-78/0432/1 ..... N78-29745 #
NTIS/PS-78/0433/9 ..... N78-30000 #
NTIS/PS-78/0434/7 ..... N78-29999 #
NTIS/PS-78/0438/8 ..... N78-29486 #
NTIS/PS-78/0439/6 ..... N78-29487 #
NTIS/PS-78/0440/4 ..... N78-29987 #
NTIS/PS-78/0444/6 ..... N78-29615 #
NTIS/PS-78/0445/3 ..... N78-29616 #
NTIS/PS-78/0447/9 ..... N78-29114 #
NTIS/PS-78/0448/7 ..... N78-29977 #
NTIS/PS-78/0453/7 ..... N78-29229 #
NTIS/PS-78/0454/5-VOL-1 ..... N78-29230 #
NTIS/PS-78/0455/2-VOL-2 ..... N78-29231 #
NTIS/PS-78/0469/3-VOL-2 ..... N78-29391 #
NTIS/PS-78/0470/1 ..... N78-29392 #
NTIS/PS-78/0471/9 ..... N78-29390 #
NTIS/PS-78/0477/6 ..... N78-29232 #
NTIS/PS-78/0478/4 ..... N78-29233 #
NTIS/PS-78/0479/2 ..... N78-29642 #
NTIS/PS-78/0480/0 ..... N78-29643 #
NTIS/PS-78/0483/4 ..... N78-29881 #
NTIS/PS-78/0485/9 ..... N78-29268 #
NTIS/PS-78/0486/7 ..... N78-29269 #
NTIS/PS-78/0491/7 ..... N78-29235 #
NTIS/PS-78/0494/1 ..... N78-29879 #
NTIS/PS-78/0495/8 ..... N78-29880 #
NTIS/PS-78/0496/6 ..... N78-29651 #
NTIS/PS-78/0497/4 ..... N78-29270 #
NTIS/PS-78/0499/0 ..... N78-29266 #
NTIS/PS-78/0500/5 ..... N78-29267 #
NTIS/PS-78/0502/1 ..... N78-29617 #
NTIS/PS-78/0503/9 ..... N78-29618 #
NTIS/PS-78/0508/8 ..... N78-29978 #

NTISUB/D/276-004 ..... N78-29538*#

NUREG-0444 ..... N78-29747 #

NVO/0655-100 ..... N78-29597 #

NWSC/CR/EDTR-73 ..... N78-29727 #

ONERA-P-1977-2 ..... N78-29524 #

ONR-CR215-226-4F ..... N78-29070 #
ONR-CR229-018-2F ..... N78-29454 #

ONRL-C-5-78 ..... N78-29960 #
ONRL-C-7-78 ..... N78-29186 #
ONRL-C-18-77 ..... N78-29314 #

ORNL-TM-5934 ..... N78-29742 #
ORNL-TM-5989 ..... N78-29962 #
ORNL-TM-6220 ..... N78-29926 #

ORNL-TR-4528 ..... N78-29924 #

OWRT-B-144-COLO(6) ..... N78-29554 #

OWRT-C-5195(4209)(2) ..... N78-29645 #
OWRT-C-7516(6236)(1) ..... N78-29619 #

PAR-76-30 ..... N78-29799 #

PB-210710/5 ..... N78-29560 #
PB-228849 ..... N78-30003 #
PB-278072/4 ..... N78-29976 #
PB-278330/6 ..... N78-29975 #
PB-278627/5 ..... N78-29080 #
PB-279091/3 ..... N78-29289 #
PB-279148/1 ..... N78-29292 #
PB-279150/7 ..... N78-29553 #
PB-279169/7 ..... N78-29979*#
PB-279173/9 ..... N78-29718 #
PB-279174/7 ..... N78-29719 #
PB-279193/7 ..... N78-29981 #
PB-279196/0 ..... N78-29272 #
PB-279217/4 ..... N78-29621 #
PB-279224/0 ..... N78-29293 #
PB-279248/9 ..... N78-30008 #
PB-279251/3 ..... N78-29336 #
PB-279252/1 ..... N78-29970 #
PB-279253/9 ..... N78-29654 #
PB-279257/0 ..... N78-29274 #
PB-279306/5 ..... N78-29715 #
PB-279311/5 ..... N78-30007 #
PB-279320/6 ..... N78-29694 #
PB-279321/4 ..... N78-29559 #
PB-279322/2 ..... N78-29273 #
PB-279330/5 ..... N78-29288 #
PB-279334/7 ..... N78-29290 #
PB-279335/4 ..... N78-29334 #
PB-279336/2 ..... N78-29488 #
PB-279337/0 ..... N78-29234 #
PB-279370/1 ..... N78-29653 #
PB-279376/8 ..... N78-29278 #
PB-279382/6 ..... N78-29982 #
PB-279383/4 ..... N78-29650 #
PB-279386/7 ..... N78-29291 #
PB-279391/7 ..... N78-29526 #
PB-279392/5 ..... N78-29468 #
PB-279395/8 ..... N78-29657 #
PB-279409/7 ..... N78-29658 #
PB-279416/2 ..... N78-29984 #
PB-279437/8 ..... N78-29561 #
PB-279440/2 ..... N78-29286 #
PB-279443/6 ..... N78-30005 #
PB-279444/4 ..... N78-30004 #
PB-279447/7 ..... N78-29989 #
PB-279448/5 ..... N78-30003 #
PB-279449/3 ..... N78-30002 #
PB-279452/7 ..... N78-29713 #
PB-279453/5 ..... N78-30006 #
PB-279454/3 ..... N78-29465 #
PB-279458/4 ..... N78-29972 #
PB-279459/2 ..... N78-29287 #
PB-279462/6 ..... N78-29647 #
PB-279463/4 ..... N78-29079 #
PB-279464/2 ..... N78-29659 #
PB-279465/9 ..... N78-29467 #
PB-279469/1 ..... N78-29646 #
PB-279470/9 ..... N78-29563 #
PB-279471/7 ..... N78-29973 #
PB-279472/5 ..... N78-29988 #
PB-279482/4 ..... N78-29783 #
PB-279483/2 ..... N78-29746 #
PB-279485/7 ..... N78-29624 #
PB-279487/3 ..... N78-29556 #
PB-279489/9 ..... N78-30001 #
PB-279496/4 ..... N78-29562 #
PB-279503/7 ..... N78-29525 #
PB-279508/6 ..... N78-29285 #
PB-279509/4 ..... N78-29840 #
PB-279512/8 ..... N78-29282 #
PB-279513/6 ..... N78-29283 #
PB-279523/5 ..... N78-29284 #
PB-279528/4 ..... N78-29693 #
PB-279534/2 ..... N78-29640 #
PB-279536/7 ..... N78-29641 #
PB-279539/1 ..... N78-29623 #
PB-279541/7 ..... N78-30010 #
PB-279572/2 ..... N78-29656 #
PB-279584/7 ..... N78-29747 #
PB-279588/8 ..... N78-29464 #
PB-279605/0 ..... N78-29645 #
PB-279607/6 ..... N78-29971 #
PB-279608/4 ..... N78-29619 #
PB-279614/2 ..... N78-29555 #
PB-279625/8 ..... N78-29644 #
PB-279628/2 ..... N78-29558 #
PB-279629/0 ..... N78-29554 #
PB-279635/7 ..... N78-29638 #
PB-279636/5 ..... N78-29639 #
PB-279637/3 ..... N78-29648 #
PB-279640/7 ..... N78-29335 #
PB-279641/5 ..... N78-29275 #
PB-279644/9 ..... N78-29733 #
PB-279646/4 ..... N78-29966 #
PB-279653/0 ..... N78-29197 #
PB-279656/3 ..... N78-29198 #
PB-279661/3 ..... N78-29784 #
PB-279663/9 ..... N78-29557 #
PB-279664/7 ..... N78-29620 #
PB-279672/0 ..... N78-29652 #
PB-279684/5 ..... N78-29866 #
PB-279689/4 ..... N78-30009 #
PB-279693/6 ..... N78-29980 #
PB-279706/6 ..... N78-29649 #
PB-279765/2 ..... N78-29782 #
PB-279768/6 ..... N78-30011 #
PB-279775/1 ..... N78-29969 #
PB-279828/8 ..... N78-29655 #
PB-279887/4 ..... N78-29466 #
PB-279919/5 ..... N78-29549 #
PB-279920/3 ..... N78-29550 #
PB-279988/0 ..... N78-29722 #
PB-280041/5 ..... N78-29708 #
PB-280068/8 ..... N78-29781 #
PB-280074/6 ..... N78-29780 #
PB-280728/7 ..... N78-29622 #
PB-280730/3 ..... N78-29696 #
PB-280731/1 ..... N78-30031 #
PB-280732/9 ..... N78-30032 #
PB-280733/7 ..... N78-30033 #
PB-280740/2 ..... N78-29709 #
PB-280741/0 ..... N78-29710 #
PB-280743/6 ..... N78-29139 #
PB-280745/1 ..... N78-29714 #
PB-280748/5 ..... N78-29720 #
PB-280772/5 ..... N78-29721 #
PB-280773/3 ..... N78-29695 #
PB-280786/5 ..... N78-29983 #
PB-280943/2 ..... N78-29711 #
PB-281195/8 ..... N78-29712 #

POMRAD-77/68 ..... N78-29980 #

PR-10 ..... N78-29604 #
PR-14 ..... N78-29611 #
PR-77-7-44 ..... N78-29713 #

PSAD-78-52 ..... N78-29561 #

PTPT-78-9 ..... N78-29254 #

PURDU-CL-77-07 ..... N78-29184 #

PWA-5509-VOL-1 ..... N78-29867*#
PWA-5509-VOL-2 ..... N78-29868*#
PWA-5509-VOL-3 ..... N78-29869*#
PWA-5512-24 ..... N78-29105*#

P76-429 ..... N78-29304*#
P78-10132 ..... N78-29115*

QPR-3 ..... N78-29441 #
QPR-5 ..... N78-29373 #
QPR-7 ..... N78-29371 #
QPR-8 ..... N78-29371 #
QPR-9 ..... N78-29371 #
QPR-10 ..... N78-29371 #
QPR-24 ..... N78-29377 #

QR-1 ..... N78-29327 #

QR-4 ..... N78-29595 #
QR-4 ..... N78-29903 #
QR-5 ..... N78-29759 #
QR-6 ..... N78-29368 #

QTPR-1 ..... N78-29600 #

QWRT-A-043-TEX(1) ..... N78-29557 #

R-5-77 ..... N78-29330 #
R-8-77 ..... N78-29382 #
R-9-77 ..... N78-29856 #
R-061E-B03-TI008 ..... N78-29460 #

RADC-TR-76-101-VOL-4 ..... N78-29355 #
RADC-TR-76-101-VOL-5 ..... N78-29356 #
RADC-TR-76-101-6-VOL-6 ..... N78-29357 #
RADC-TR-78-33 ..... N78-29776 #
RADC-TR-78-44 ..... N78-29799 #
RADC-TR-78-55 ..... N78-29365 #
RADC-TR-78-70 ..... N78-29319 #
RADC-TR-78-74 ..... N78-29773 #

RAE-LIB-TRANS-1923 ..... N78-29452 #
RAE-LIB-TRANS-1961 ..... N78-29354 #
RAE-LIB-TRANS-1968 ..... N78-29311 #
RAE-LIB-TRANS-1969 ..... N78-29218 #

RE-554 ..... N78-29906 #

REF-M77-91 ..... N78-29718 #
REF-M78-8 ..... N78-29722 #

REPT-1 ..... N78-29411 #
REPT-16 ..... N78-29124 #
REPT-21 ..... N78-29829 #
REPT-30 ..... N78-29489
REPT-77-1 ..... N78-29750 #
REPT-77-1-1 ..... N78-29674*#
REPT-77-9C1-PULCO-R1 ..... N78-29440 #
REPT-77-106 ..... N78-29929 #
REPT-78 ..... N78-29665*#
REPT-78-8LO-DISPL-R2 ..... N78-29368 #
REPT-78-0332 ..... N78-29373 #
REPT-1338-01-2-1736 ..... N78-29325 #
REPT-2340-F ..... N78-29589 #
REPT-8306-77-120 ..... N78-29468 #
REPT-19701-657218 ..... N78-29657 #
REPT-633489 ..... N78-29291 #

RFP-2621 ..... N78-29459 #

RHO-SA-5 ..... N78-29192 #

RHR-78-035 ..... N78-29584*#

RLO/2439-77/2 ..... N78-29590 #

RPI-TR-MP-58 ..... N78-29131*#
RPI-TR-MP-59 ..... N78-29132*#

RR-78-59 ..... N78-29292 #
RR-112 ..... N78-29464 #
RR-504 ..... N78-29701 #

RSC-3458-2 ..... N78-29532*#

RT-225 ..... N78-29805 #

SAI-78-008-WH ..... N78-29188 #
SAI-78-089-DEN ..... N78-29754*#
SAI-78-699-WA ..... N78-29128 #

SAN-REVIEW-4-77 ..... N78-29737 #

SAN-TR-77-24 ..... N78-29737 #
SAN-TR-77-29 ..... N78-29739 #
SAN-TR-77-33 ..... N78-29904 #
SAN-TR-77-3723 ..... N78-29738 #
SAN-TR-78-5 ..... N78-29801 #

SAMSO-TR-77-216 ..... N78-29137 #
SAMSO-TR-78-87 ..... N78-29129 #

SAN/0700-1 ..... N78-29460 #

SAND-77-0500 ..... N78-29256 #
SAND-77-0553C ..... N78-29378 #
SAND-77-1061C ..... N78-29606 #

SAND-77-1734C ..... N78-29255 #
SAND-77-1951 ..... N78-29608 #
SAND-77-8287 ..... N78-29591 #
SAND-78-0144 ..... N78-29280 #
SAND-78-6001 ..... N78-29257 #
SAND-78-8206 ..... N78-29603 #

SATR-1 ..... N78-29796 #

SCIENTIFIC-1 ..... N78-30029 #

SC5099.1IR ..... N78-29248 #

SD-78-SH-0125 ..... N78-29141*#
SD-78-SH-0141 ..... N78-29144*#
SD-78-SR-0009-1 ..... N78-29119*#
SD-78-SR-0009-2 ..... N78-29120*#
SD-78-SR-0009-3 ..... N78-29121*#
SD-78-SR-0009-4 ..... N78-29122*#

SEE-3-NO-65 ..... N78-30029 #

SGD-402-PT-1 ..... N78-30031 #
SGD-402-PT-2 ..... N78-30032 #
SGD-402-SUPPL ..... N78-30033 #

SQUID-PU-R1-78 ..... N78-29088 #

SQUID-UHO-3-PU ..... N78-29185 #

SR-83 ..... N78-29722 #

SRC-TR-77-513-PT-2 ..... N78-30010 #

SRI-CSL-49 ..... N78-29803 #

SRI-ERU-5551 ..... N78-29703 #

SRI-TR-1 ..... N78-29702 #
SRI-TR-77-08 ..... N78-29703 #

STEWS-ID-78-1 ..... N78-29320 #

STI-TR-1063-3 ..... N78-29699*#

STRUCTURAL-RESEARCH-SER-446 ..... N78-29289 #

SU-DAAR-508 ..... N78-29110*#

SU-SOL-77-32 ..... N78-29797 #
SU-SOL-77-33 ..... N78-29824 #

SU-TR-15 ..... N78-29825 #
SU-TR-255 ..... N78-29825 #

TAE-303 ..... N78-29502 #

TB-137 ..... N78-29501 #

TDCK-69911 ..... N78-29743 #

TID-27914 ..... N78-29604 #

TN-21 ..... N78-29819 #
TN-1978-1 ..... N78-29326 #
TN-1978-7 ..... N78-29328 #

TOP-7-2-511 ..... N78-29091 #

TPR-047 ..... N78-29567*#

TR-EE-77-40 ..... N78-29359 #

TR-1 ..... N78-29894 #
TR-2 ..... N78-29364 #
TR-4 ..... N78-29961 #
TR-9 ..... N78-29250 #
TR-22.2157 ..... N78-29364 #
TR-24 ..... N78-29957 #
TR-33 ..... N78-29718 #
TR-78-01 ..... N78-29187 #
TR-200 ..... N78-29069 #
TR-630 ..... N78-29795 #
TR-0078(3960-01)-1 ..... N78-29137 #
TR-0078(3960-04)-4 ..... N78-29129 #
TR-3074 ..... N78-29911*#
TR-70615 ..... N78-29749 #
TR-70820 ..... N78-29755 #

TRB/SR-181 ..... N78-30009 #
TRB/TRR-632 ..... N78-29284 #

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